INDEX TO ADVERTISERS AND CONTENTS PAGE 34.

THE FOUNDRY

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G. H. GARDNER, PRESIDENT AND TREASURER.
JOHN A. PENTON, VICE-PRESIDENT.
A. I. FINDLEY, SECRETARY.

JOHN A. PENTON, - - - - - - - Editor.
HENRY HANSEN, - - - - - Associate Editor.

CHICAGO: 934 Monadnock Blk., GEO. H. GRIFFITHS.
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Trade Outlook.

The death of the chief executive in the midst of the most prosperous period in American history may, temporarily at least, leave its imprint upon the volume of trade. The vast majority of American manufacturers were firm believers in the policies so ably represented by Mr. McKinley, and the untimely termination of his successful career makes him more than ever the idol of those whose business has prospered under his regime.

The settlement of the steel strike at the plants of the United States Steel Corporation is bound to stimulate the foundry trade, as well as many other branches of manufacture. Much work has been held in abeyance pending a final settlement of this difference and partial suspension had taken place in lines, where the product of the mills was necessary, such as steel ranges and many others where castings are only a part of the finished output.

From all reports at hand choice brands of foundry iron are sold well ahead, and the general tendency among large buyers to only contract for immediate wants seems to be gradually disappearing as it becomes more and more apparent that no material change in prices is to be expected. The leading specialty manufacturers are covering their wants as far ahead as the first six months of next year, and others who neglect doing so may find it necessary to make considerable change in their mixtures. Soft foundry irons are especially scarce, with an indication that the demand exceeds the supply.

From several quarters a scarcity of molders are reported, though this may be as much due to unfavorable local conditions, as to any real lack of skilled mechanics. Considerable difference exists in wage conditions, and it is but natural to suppose that the shops paying the lowest rate will have to get along as best they can. Even granting that the question of pay is satisfactory, the peculiar treatment meted out to workmen in some establishments does not tend to secure a steady set of employees.

The expanse of the foundry business during the past two years has been most remarkable. Not only have malleable iron and steel casting establishments greatly increased in number as well as capacity, but gray iron foundries have come into existence at an even greater ratio.

Low Prices.

The oft repeated statement that many foundries make a habit of basing their bids for castings upon what their competitors are receiving, rather than upon individual judgment of what the job is worth, receives confirmation every now and then. The shops following this practice seem to believe that if their neighbors can turn out certain castings for 2½ cents per pound that they can make money if they only receive 2¼ cents, and the shop further down the line probably argues that if there is a profit at 2¼ cents it ought to come out whole at 2 cents, and so it keeps on, until a shop suddenly learns that it is selling castings below cost of production. Strange as it may seem many foundries are turning out contracts year after year at a loss, owing to the fact that they do not know the cost of individual jobs. Their balance sheet shows a profit at the end

of the year and that satisfies them. It ought not to take much argument to show that it is much better never to make a casting at all than to make it at a loss. What our foundries need more than anything else is to weed out jobs that do not pay.

One shop we know of has fallen into the habit of charging 2 cents per pound for everything that comes along. Needless to say this leads to some rather curious situations at times. One lot of 68 castings, weighing 17 pounds, was recently turned out, for which 34 cents were received. In another 2-cent contract it requires about twenty molders and ten helpers to turn out 6,500 pounds of castings a day, the price including delivery at a point 350 miles away. A casting, requiring to be made in a three-parted flask and weighing from 10 to 18 pounds each, a molder making from 13 to 18 castings a day, is delivered at Havana, Cuba, at the rate of $2.20 per hundred pounds. Who will say that such a shop does not need a little instruction as to the cost of its castings?

Curiosity Shops.

Hot Springs, in the state of Arkansas, is far-famed for the curative power of its springs. It is also the possessor of a foundry whose reputation is not so extensive. What distinction it enjoys is not for any remarkable castings turned out therein, but on account of being a type of the backwoods foundry of which there are but few.

A foundryman who recently went there to unload a case of rheumatism writes us that this shop has shut down for the present, the reason of its withdrawal from the market being that one of the wooden posts supporting the cupola caught fire from a run-out in the bottom of the cupola and burned off, when the aforesaid cupola tipped over on top of an upright boiler and caused the latter to burst. The incident passed off without injury to anyone.

To the Patternmaker.

Give the molders a show. They are not angels, or they wouldn't be in the foundry. More than half the kicks they register against the patternmaker are well deserved. Following are a few suggestions:

It isn't necessary to draft all parts of a pattern the same way; if some of the mold tears up, it's easy for the molder to patch it, just to keep his hand in, and it's good for his disposition.

Make as many loose pieces as possible; the molder likes to lose them. Even if he forgets one or two, it won't make any difference if they are left off the casting.

Make ribs that are from ¼ to ¾ inch high, loose; as it shows to advantage on the parting of the casting, besides the molder can't make as deep a lift as that. If the drawing shows a part square, be sure to make the pattern that way; don't use any common sense as to whether it makes any difference in the casting if you put draft on it.

Put as many loose pieces on sides of pattern as possible; the molder likes to fish them out. Don't use a cover core, if it takes you fifteen minutes to make the core box. It is no trouble for the molder to use a three-part flask, even if it does take him a half hour to find it.

Should you put core prints on drag half of pattern for long cores, the molder might find it easy to set the core. Make core prints perfectly square without any draft, even where plenty of draft is possible; it is much better to save a half hour in the pattern shop and lose two in the foundry. You need not bore vent holes in core boxes; the core maker can drive a nail through; it won't matter if he does split it. Or, he can bring it back to you to have holes bored; his time isn't worth anything. If you bore dowel holes through core boxes, the core maker wouldn't have to dig sand out of them; he could punch it through.

Be sure to leave ample finish; it isn't expensive to remove unnecessary stock in the machine shop. Where holes are to be drilled in castings that do not require to be accurately spaced, a countersink in pattern might save the machinist the spacing of numerous castings.

Leave your dowels tight in drag half of pattern; then the molder can draw the entire pattern with his cope. Use soft wood dowels so that they can swell and stick. Then, too, the molder can whittle them easier, for you know he is an artist with a jack-knife. Put your dowels as close together as possible; it helps the looks of the casting at the parting.

In holes that leave their own core don't get them too smooth; the sand would not stay in them. Where two or more prints are for the same core, if you are careful to get the print spacing the same as the core box, the molder might get the cores in easily and throw him into a fit. It isn't necessary to part some patterns, it takes dowels and labor. The molder can make a parting without any trouble, or it's easy for him to dig it out; he likes that. A

long print isn't at all necessary for overhanging cores, the molder only thinks it is.

Anything the molder can draw will be sure to run, whether he can vent it or not. You can sometimes save making a core box by letting the molder lose half his castings for want of it.

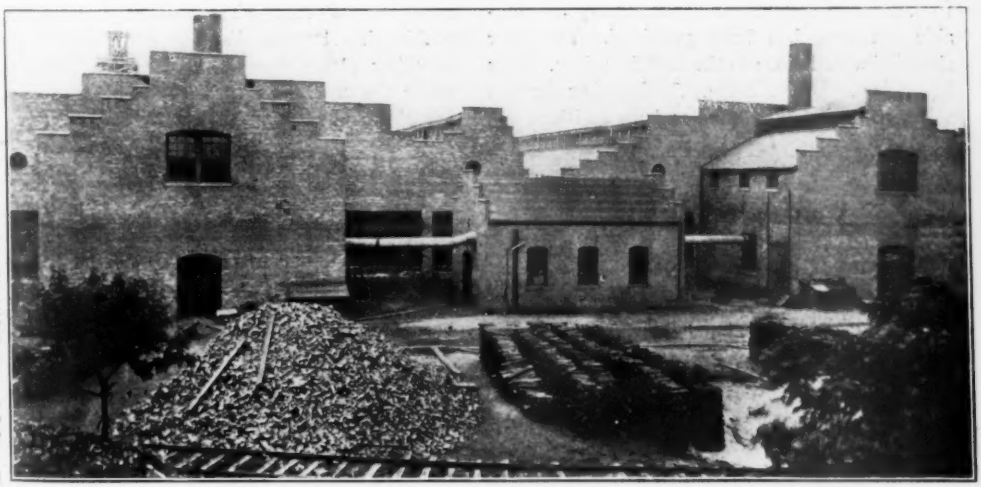
J. L. GARD.

PLANT OF INTERSTATE FOUNDRY CO., CLEVELAND, OHIO.

Plant of the Interstate Foundry Co., Cleveland, Ohio.

The Interstate Foundry Company of Cleveland, Ohio, has completed its foundry for light castings and that part of the plant has been placed in operation. The foundry proper contains a little over 42,000 square feet of floor surface, all in one room the only obstruction being two rows of columns supporting the roof. Another foundry, covering an equal area, is contemplated, this to be devoted to machinery castings and heavy work in general.

Careful provision has been made to secure light and ventilation. The roof is of the sawtooth type, each span being 40 feet wide. One side of the slope is set at an angle of 22½ degrees and the other at 67½ degrees. The steep side of each span is filled with heavy rough plate glass and faces the north. The result is that the entire shop is as light as day, yet without the inconvenience and discomfort of the sun's direct rays as in buildings dependent upon roof lights. The opposite side of each span is provided with 28 ventilator windows which are easily adjusted, providing perfect ventilation.



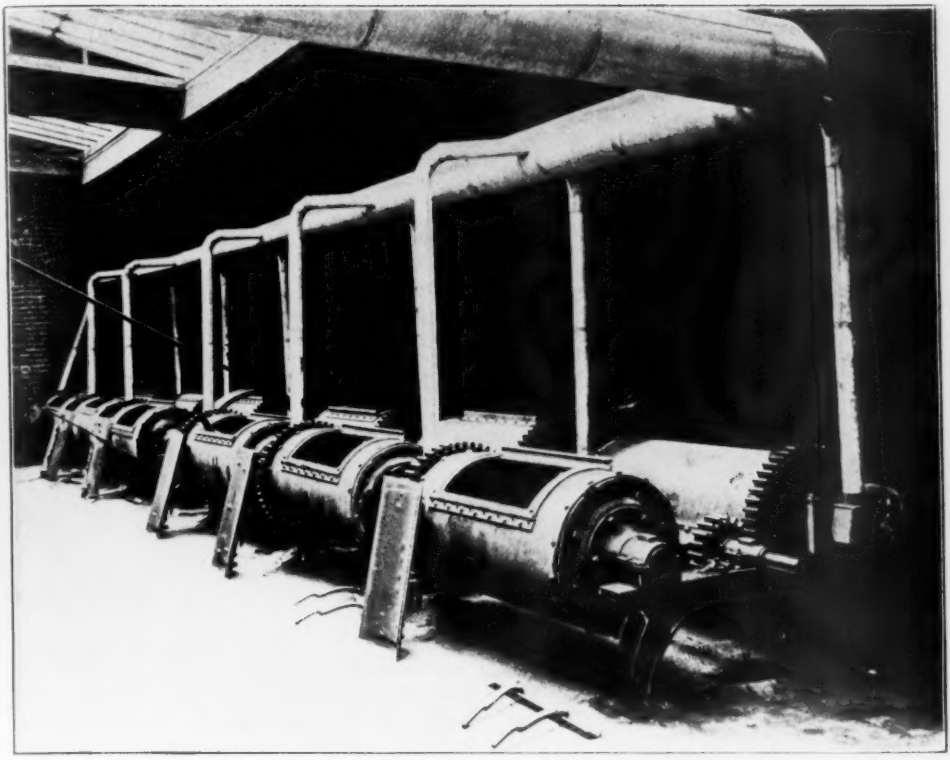
A REAR VIEW OF THE INTERSTATE FOUNDRY, SHOWING ARRANGEMENT OF CUPOLAS.

As nearly the whole output of the foundry is comparatively light castings, but little handwork is done in cleaning them, tumbling barrels of approved patterns being employed. The room in which these are located is 200 feet long

FORM OF ROOF CONSTRUCTION, INTERSTATE FOUNDRY.

by 50 feet wide. The hand finishing shop, store house, pattern and carpenter shop and the shipping room are contained in a two-story building on the street front, also 200 feet long by 50 feet wide. A pattern safe, built especially for safekeeping and easy accessibility of valuable patterns, has been provided. The core shop is located close to the molding shop. It is 85x50 feet. Under half of the building there is a basement for sand, etc., and all facilities are at hand for fast work. The company's railroad switch passes around two sides of the plant. On this are located the boiler and engine house, the cupola houses, the core shop, and the foundry proper. Thus materials are thrown from the railroad cars directly into special bins within the shortest distance from the cupola, or other places for which they are intended, while the castings are conveyed direct to cars for shipment.

INTERIOR VIEW, INTERSTATE FOUNDRY.



BATTERY OF SLY EXHAUST TUMBLING BARRELS, INTERSTATE FOUNDRY.

Foundry Costs.

In the July issue of THE FOUNDRY there appears a paper read before the American Foundrymen's Association at its recent convention at Buffalo by Mr. R. C. Cunningham of Holyoke, Mass., on the subject of "Foundry Costs," and, while he holds up the foundrymen's end in a very interesting manner, he does not lose any opportunity to call the patternmaker down for his slipshod and unmechanical work; in fact, he throws the whole blame at his head for all the unnecessary work and consequent high cost of castings.

Now I cordially disagree with Mr. Cunningham in this contention, particularly when he claims that, nine times out of ten the requirements of the foundry are not considered by the patternmaker of sufficient importance to consult the foundry foreman as to the cheapest and best method of molding a pattern.

OTHER TYPES OF TUMBLING BARRELS, INTERSTATE FOUNDRY.

CORE ROOM, INTERSTATE FOUNDRY.—OVENS ARE AT OPPOSITE END.

My experience as a patternmaker covers a period verging on to twenty-seven years, and in the last fifteen years I have had dealings with a goodly number of foundry foremen connected with jobbing foundries in this part of the country, and with but one exception it has yet to be my good fortune to meet a foundry foreman who can read a drawing with enough intelligence to make a consultation with the patternmaker profitable alike to both. I do not write this in any unkind spirit, but to state facts as I find them, and it is with pleasure that I can say that most all of these men were good mechanics, but they simply can not read a drawing, although they can tell you all about how a pattern should have been made after they see it in the finished state, and judging by what I hear from other members of my craft who have travelled extensively through this fair land of ours, my experience is not an uncommon one in this respect by any means, but should be a sufficient refutation of the charges brought forward by Mr. Cunningham.

CLEANING ROOM, INTERSTATE FOUNDRY

INTERIOR VIEW, INTERSTATE FOUNDRY.

The one exception I refer to was a big, brawny Scotchman, a week-old foreman of a nearby foundry, who had been sent for to decide how he wanted a very complicated pattern that he was to mold, made. He came into the shop like a whirlwind, with the remark that he would like to see the blue print for a little while, and after looking at it not more than five minutes, he went into the minutest details as to just how he wanted everything made, in a way that would have convinced any one that he knew what he was talking about. As he was leaving the shop, I asked him what he thought the casting would weigh, and after another glance at the drawing, he said two and a half tons, and was gone like a flash, and with him the high opinion I had formed from his masterful handling of that drawing, for I had inwardly taken a guess at the weight of that casting, which was only a ton shy of his; but

SHIPPING DEPARTMENT, INTERSTATE FOUNDRY.

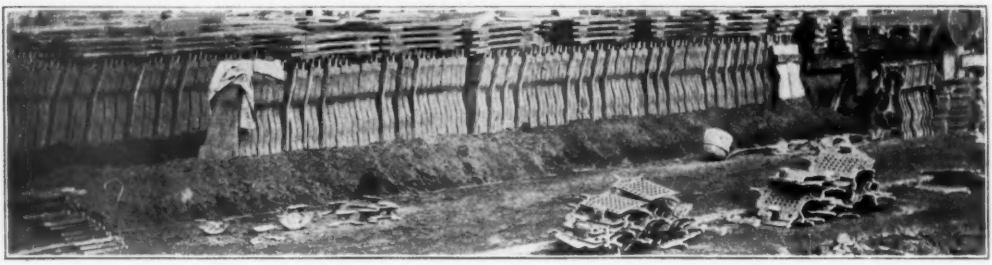
this braw lad from the land of Bobbie Burns knew his business, as the casting weighed within a few pounds of his guess, and my respect for him increased as suddenly as my own conceit decreased. I regret to say that this man died young, which is a fault, so I've heard, with all good Scotchmen.

Mr. Cunningham lays particular stress on the poor condition of patterns sent to the foundry, which makes extra work for the molder, and he certainly is right, but I'll ask Mr. Cunningham to tell us who put the patterns "*hors de combat.*" Wasn't it the careless molder with his vent wire that must be jabbed well into the pattern until pitted beyond recognition on the cope side, or was it his rapping bar of generous proportions that is driven deeply with unerring aim and fondness for the exact center of glue joints; scorning the presence of rapping plates as being placed improperly and pounding the dowel pins and holes until the "shake" of the pattern makes it well nigh impossible to make a decent casting? Stop these little practices of your molders and your patterns will live longer.

On the question of firms who expect their foremen to turn out first-class castings with poor and cheap flasks it isn't hard to agree with everything he claims, as it is impossible to do good work with poor tools, and I think we can learn something from our brethren on the "other side" of the herring pond in this matter, as they use metal flasks almost exclusively, it being a rare case indeed when a wooden flask is used, while with us the reverse is the case because of the mistaken idea of cheapness, though I notice a growing tendency of late years in the use of metal flasks—at least in this part of the country—which should become universal, as the life of the wooden flask is very uncertain, usually running into a decrepit and shaky old age prematurely.

PATTERNMAKER.

Brooklyn, N. Y.



A "SEWING MACHINE" FLOOR, INTERSTATE FOUNDRY.

Of What Material was the Cupola Made?

The Rogers Grey Iron Co.'s foundry caught fire last evening at 6 o'clock from a spark from the cupola. The blaze was confined to the cupola and was extinguished at a loss of $25.—[*Springfield (O.) Press.*

A Patent Facing.

Mr. Marshall B. Owens of Granite City, Ill., claims to have produced a new facing which will peel steel castings slick and clean.

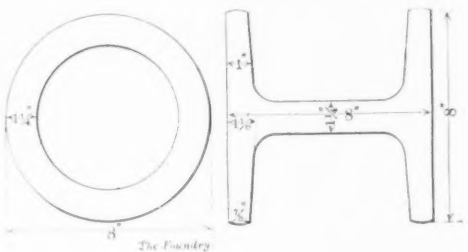
The inventor says that he prefers to take four barrels of black sand, one barrel of white sand, and one-half barrel of fire-clay. After mixing this together he adds about one-quarter barrel of chloride of ammonia dissolved in a quantity of water, this solution being intended to give the facing proper dampness.

He claims that the hot metal coming in contact with the facing decomposes the chloride and forms a gas, which, in its nascent state, cleans the face of the castings.

Strength of Columns.

The sketches shown herewith are cross-sections of two columns which will vary in length from 10 to 16 feet. I would like to have an opinion from the readers of THE FOUNDRY as to which one of these designs will be the stronger.

C. A. SNOW.



CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

Castings for Resisting Heat.

A few days ago a clipping from one of the trade papers was sent to me stating that a firm in a neighboring city was manufacturing castings that would resist high temperatures much better than any iron before made. It was claimed that "tests had been made in furnaces employing intense heat where castings of ordinary mixture had been rendered utterly useless in 20 days' time, while a casting of the heat resisting mixture, doing the same daily service, lasted a period of 62 days, thereby saving the user the renewals as well as the loss in the output of material being manufactured." I am asked for an opinion.

Answer. A similar question was answered about a year ago. I have asked the makers of grate bars if they knew the chemical composition that would cause the casting to last longest. I have never found any one who knew. The old rule of whatever is is right seems to apply in this case. Grate bars and fire linings are generally made from iron very low in silicon and with a very close grain. Such iron is used because it costs less than any other and because such castings have given good satisfaction. This would indicate that such iron was suitable for the purpose.

The castings we are speaking of are located so that they are in contact with the fuel or are in contact with the flame for long periods.

It has been found that carbon monoxide will enter the surface of red-hot cast iron and will pass entirely through the casting and will enter the air from the other side of the casting. This is one reason that air seems burnt and gives one a headache when a room is heated by a red-hot stove, though the peculiar smell of such air is generally produced by the burning of the atoms of woolen that float as dust in the air and come in contact with the hot surfaces. Oxygen unites with red-hot iron quite readily, forming a scale of oxide of iron or rust, while at a red heat the various compounds of which cast iron is composed are oxidized to a greater or less extent.

It has been found that iron that has the greatest amount of graphite and which contains the least silicon, phosphorus, sulphur or manganese will offer the greatest resistance to high temperatures. It would therefore seem that cast iron made from the purest ores and in the hottest furnace would make the best castings for contact with fire.

I do not know what influence chromium or titanium would exert; I am simply considering the action of incandescent fuel or of an oxidizing flame on red-hot iron.

It has been found that annealed malleable iron will not resist heat nearly as well as castings made of the original pig iron melted in a cupola, probably for the reason that during annealing more than half of the carbon has been removed, while Si, P, S and Mn were not much changed.

Castings made of malleable scrap melted in a cupola are white and do not withstand heat at all. I have a memorandum of the following analyses showing the action of heat. The upper part of a coke-oven door showed sound iron at the outside and a burnt iron core, while the inner surface exposed to the heat directly was covered with a scale which had evidently been fused. The analysis was as follows:

	Sound Iron.	Burnt Iron.	Scale.
Iron	90.82	81.25	60.84
Silicon	2.57	1.87	3.88
Manganese ..	.88	.77	.78
Phosphorus ..	1.71	1.05	2.81

Another massive burnt casting contained a core slightly burnt, the parts around it more so, while the surface was covered with scale. The composition was:

	Core.	Burnt Iron.	Scale.
Silicon	2.19	2.32	3.07
Phosphorus	1.50	1.63	2.17

The next example is a piece from a pot that had been used for annealing malleable iron. The pot was likely made from malleable scrap and probably was white iron. The center of the casting had become a dark gray with a fine grained fracture and the casting was covered inside and out by a scale. The analysis was:

	Burnt Core.	Scale.
Silicon	2.06	3.54
Phosphorus	.28	.68

Another annealing pot probably made of gray iron yielded the following analysis:

	Sound Iron.	Burnt Iron.	Scale.
Silicon	1.84	1.73	1.36
Phosphorus	.85	.45	.12
Manganese	.73	.68	.79

This composition is more like that of iron ordinarily used for grate bars and it behaves differently from the above irons, which were higher in silicon and phosphorus, and seems better adapted for such use. For resisting high temperatures for long periods the silicon,

phosphorus and sulphur should be low, but there must be just enough silicon to cause the formation of graphite, which is the best protection of iron against oxidation.

NOTCHING AND CASTING BRANDS ON PIG IRON.

The question of fuel ratio in melting is bound to engage the attention of the foundry in the near future. It has been thought impossible to make iron hot enough for stove plate and melt 10 lbs. of iron to 1 of coke, but several foundries are doing it. One of the requirements is that the usual ½ pigs of iron shall be broken in two. At present this is an expensive and inconvenient operation. When piles are close together in the foundry yard the iron is apt to get mixed after being broken and the men are apt to use more than they should of the iron which breaks easiest, when they get a little behind.

These drawbacks could be removed if pig iron was cast with a notch in the bottom of each half pig and if an abbreviation indicating the brand were cast on each of the four sections of a pig. This is a common practice in other countries. The drawing shows the desired pig. This would not cost anything at the furnace and in the yard it would prevent mistakes in making up charges. The only objection would be that the fracture would not be as open at the notches as if the section was the whole depth of the pig, but the fracture would be more even, as the usual closeness at the bottom of the pig could not be seen. The percentage of silicon should be given with each car.

Each piece of pig containing the brand mark would be an advertisement for the iron.

If the makers of pig iron will cast notches in their pigs and will send the brand that will be cast on each section, we shall be pleased to publish the fact in this column.

Grading of Pig Iron by Analysis.

Editor *The Foundry:*

In Mr. Keep's criticism of my remarks at the Buffalo Convention of the American Foundrymen's Association, he states on page 5 of your September issue:

"Mr. Colby is in error, however, when he intimates that a close grained iron from one furnace and a coarse grained iron from another furnace both cast in sand molds and both having the same chemical composition will make castings of the same physical quality.

"The difference in grain shows that the two furnaces were working under different conditions.

"At present it would not be safe to let a furnace deliver any kind of a grained iron because its silicon or sulphur were as specified.

"It is absolutely necessary that the founder knows the percentage of silicon that the iron he uses contains, but as the matter now stands it is not quite safe to ignore the fracture altogether."

In answer to my inquiry Mr. Keep writes me that in his first paragraph, quoted above, he refers to my statement, as follows (note the italics).

"This carefully conducted experiment proves beyond doubt that in two lots of pig iron, similar in chemical composition, *including total carbon*, that the proportion of the total carbon present in the combined state in each lot of pig iron, exercises no influence whatever on the properties of castings made from the two pig irons after remelting."

Mr. Keep has failed to notice that I specify that the *total carbon*, as well as the other constituents, must be alike. Under these conditions of *entire* similarity in the chemical composition, I was not in error in stating that the close or open grained fracture of the two irons will have no influence on the physical qualities of the castings made therefrom.

Those whose experience in applying chemistry to the foundry indicates otherwise have been misled either by inaccurate chemical work, or unrepresentative sampling; or else have based their conclusions on partial analyses or insufficient data.

I made no statement intimating that "it would be unsafe to let a furnace deliver any kind of a grained iron because its silicon or sulphur were as specified" (however, sand-cast pigs of dissimilar appearance often have identical composition), nor did I intimate that a foundry iron made when the furnace was working badly (and hence usually deficient in total carbon) would make as satisfactory a casting as an iron of similar silicon and sulphur contents made under normal furnace conditions.

The foundryman who specifies certain silicon and sulphur, and an open grained fracture, has made a decided advance over the man who still purchases iron entirely by grade. Both often pay an unnecessary bonus for the appearance or reputation of the iron, and both would get more uniformly successful castings

at a less cost by obtaining a full analysis of their good castings, and then buying *entirely* on chemical specifications, the cheapest irons obtainable on the market, which, when mixed and melted, give the chemical composition desired.

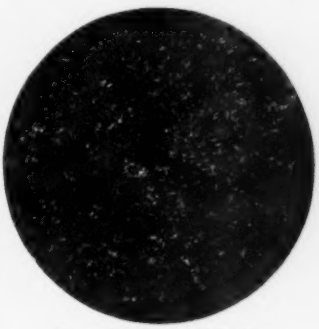
At equal prices the foundryman will effect a further saving by giving preference to a machine cast iron of the chemistry specified, rather than a sand cast iron.

Bethlehem, Pa. ALBERT LADD COLBY.

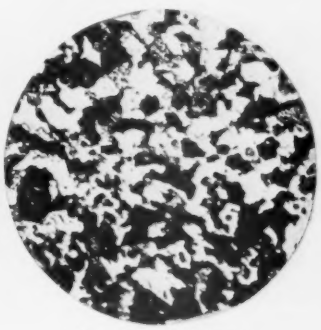
Annealing of Steel Castings.

The purpose of this paper is confined only to the annealing of such steel as is used in the ordinary branches of the manufacture of castings. Since steel for many purposes is gradually replacing cast iron, being one of its strongest competitors, and as the output is rapidly increasing, the knowledge of its properties and the best means of handling it in the various stages of manufacture should keep step with its marvelous growth and adaptability.

Unannealed Steel.



Properly Annealed Steel.



Over Annealed Steel.

MAGNIFIED 140 DIAMETERS.

The familiar quotation, "as true as steel," has on many occasions received a rude shock, leaving a doubt in the minds of its users as to the fitness of the phrase. Mention may be made of the United States Government going back to the old-fashioned wrought-iron anchors for its ironclads in view of the treacherous and mysterious failures of the most approved type, of cast steel kedge anchors. Other instances could be introduced along similar lines, proving that steel may be ideal in its chemical composition, following the most rigid specifications for any given class, and yet without any warning and possibly at a most critical time may fail in service or manifest an excessive degree of brittleness. The natural question is—what causes brittleness? With abnormal chemical composition the answer might be comparatively easy, but when normal chemically the mystery becomes intensified. The question of unexplained failures has received the attention of many noble and patient investigators; each advancing elaborate hypotheses and theories with some degree of truth; but it remained for the microscope to give the true explanation leading up to the cause of brittleness in steel, and by its use, showing how such can be lessened or prevented. Herein lies the microscope's usefulness to the advanced metallurgist seeking for causes not understood in the light of the usual chemical analyses of steel castings. The writer holds to the view that brittleness in finished castings is due to a degree of crystallization as a result of imperfect heat-treatment. This being true, as proved by tests and experiments, the nearer cast steel approaches a non-crystalline or distinctly amorphous structure, the less will be the degree of brittleness, or conversely the greater the degree of toughness. It can be shown that it is possible to have two pieces of steel identical in composition, yet possessing contrasting physical properties. To the uninitiated this may seem very mysterious, but when the effect of heat-treatment is understood the explanation is simplified by the comparative study of the structure of the pieces as revealed by the microscope. Great credit is due to Sauveur and other eminent microscopists, who by their labors have given the world knowledge of much moment to the industrial side of the metallurgy of steel.

Before advancing arguments in the support of the necessity of annealing all ordinary steel castings, it may be helpful to mention briefly the effect of heat upon the micro-structure of cast steel and its physical properties, since the relation between the two is distinct. The term "annealing" herein used is not meant that long continued heating at a white heat generally

accepted as annealing, which in reality is mere soaking. Properly stated, annealing is that process of heat-treatment of cast steel by which crystallization or brittleness is removed, conferring upon the metal its best possible physical condition, the degree of heat being governed by the carbon content, and the length of time by the size of the piece. If a piece of steel be allowed to cool (not quenched) from the casting temperature its fracture will be more or less crystalline, and the micro-structure correspondingly coarse, depending upon the initial temperature and the rate of cooling. Such steel possesses fairly good tensile strength, low elongation and comparatively no resistance to impact. Upon re-heating to a suitable temperature the changes in the crystallization, if fractured, are very marked; the large ones of the original piece having disappeared, being replaced by a very fine grain. The micro-structure will be found also very fine, with the carbon compound evenly distributed throughout the mass. Such steel will be slightly lower in tensile strength, will be much improved in elongation and reduction of area, and all brittleness being removed, the steel can then be hammered cold, bending flat upon itself without fracture. This last named test gives more information in the opinion of the writer as to the physical condition as a result of careful heat-treatment than can be gained by the steady pull of a testing machine, even with considerable elongation, usually regarded as an evidence of toughness, since it is known that steel can elongate and still have little resistance to shock. It is the purpose of this article to emphasize the need of careful and intelligent annealing, necessitating the dissolving of the varied opinions as to whether steel castings should or should not be annealed when not supported by facts gained by patient trial or investigation. There is no part of the manufacture of steel castings that receives more abuse than the re-heating, and it is not to be wondered that some claim that such treatment is not necessary; but when it is understood that the best possible physical properties of normal steel for a given class can only be acquired by careful heat-treatment there can be no doubt that any manufacturer of steel castings with the aim to reach the best results will be willing to give the problem serious attention.

Given a normal chemical composition, the physical properties of cast steel regarding resistance to all strains, then, are solely a function of heat-treatment; so to produce the desired and most important quality, namely, *resistance to impact*, the temperature of annealing is confined necessarily to certain limits; otherwise the attempt is defeated, since a high heating produces crystallization and its equivalent, brittleness; or in the case of too low a heating the original coarsely crystalline structure conferred by the casting temperature will not be removed. Herein lies the secret of tough steel.

The writer, as chief chemist for the Shickle, Harrison & Howard Iron Co., St. Louis, was led to take up the study of cast steel by means of the microscope. Needless to say, its value as an adjunct to a modernly equipped laboratory is inestimable. The photo-micrographs submitted are of steel made by the above firm, and are considered fairly representative of twenty-five to thirty carbon steel, and are uniformly magnified one hundred and forty diameters.

In conclusion, with the deserving attention to both the chemical composition and subsequent heat-treatment, steel castings can be made with such properties physically that will insure results in service to an extent that when not strained beyond the elastic limit of the metal they will have a life that will be practically indefinite.

W. M. CARR.

The Krank's Korner.

Walter J. May is an amusing cuss on the other side of the Atlantic who occasionally lets his thoughts wander towards the foundry business. He is a strong believer in certain fluxes, in fact considers them quite necessary to turn out clean castings, whereas ninety-nine per cent of foundrymen think otherwise, and manage to have solid castings, too. One of Mr. May's latest attempts to elevate the foundry is found in the following article, which he recently contributed to an English journal, and wherein he advances some, to say the least, original ideas for making

FINE IRON CASTINGS.

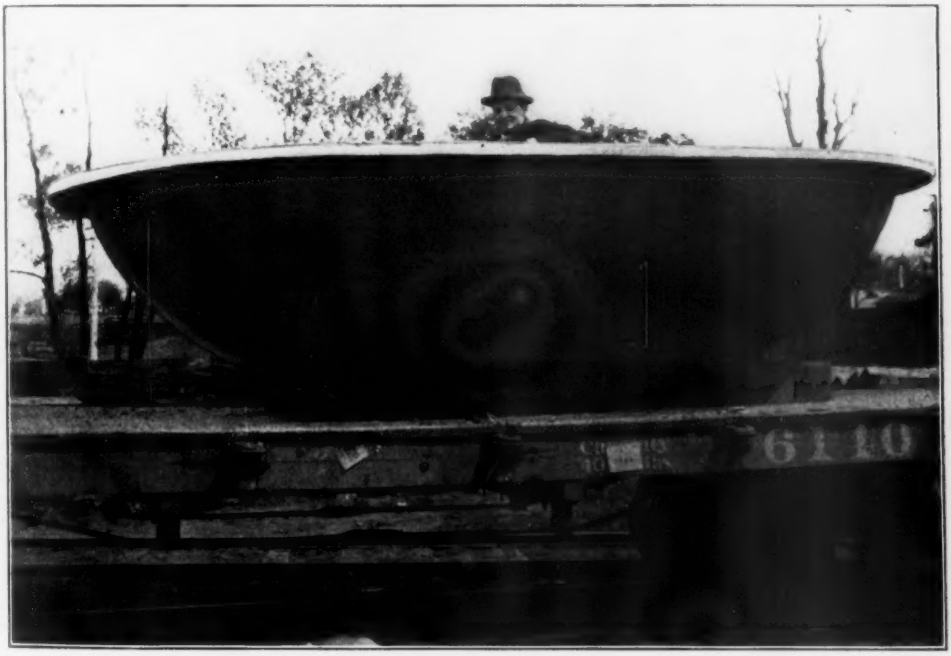
At one time it was necessary to make some fine castings of extreme thinness—from 1-32 to 3-32 in. in thickness—and of fair size, and the chief difficulties presenting themselves lay in the sand, the iron, and the trouble of obtaining sufficient fluidity to ensure the metal running up sharp.

The trouble with the iron was soon got over. It was found that Gartsherrie No. 1 foundry pig gave soft castings, and that the softness of the metal prevented any trouble in regard

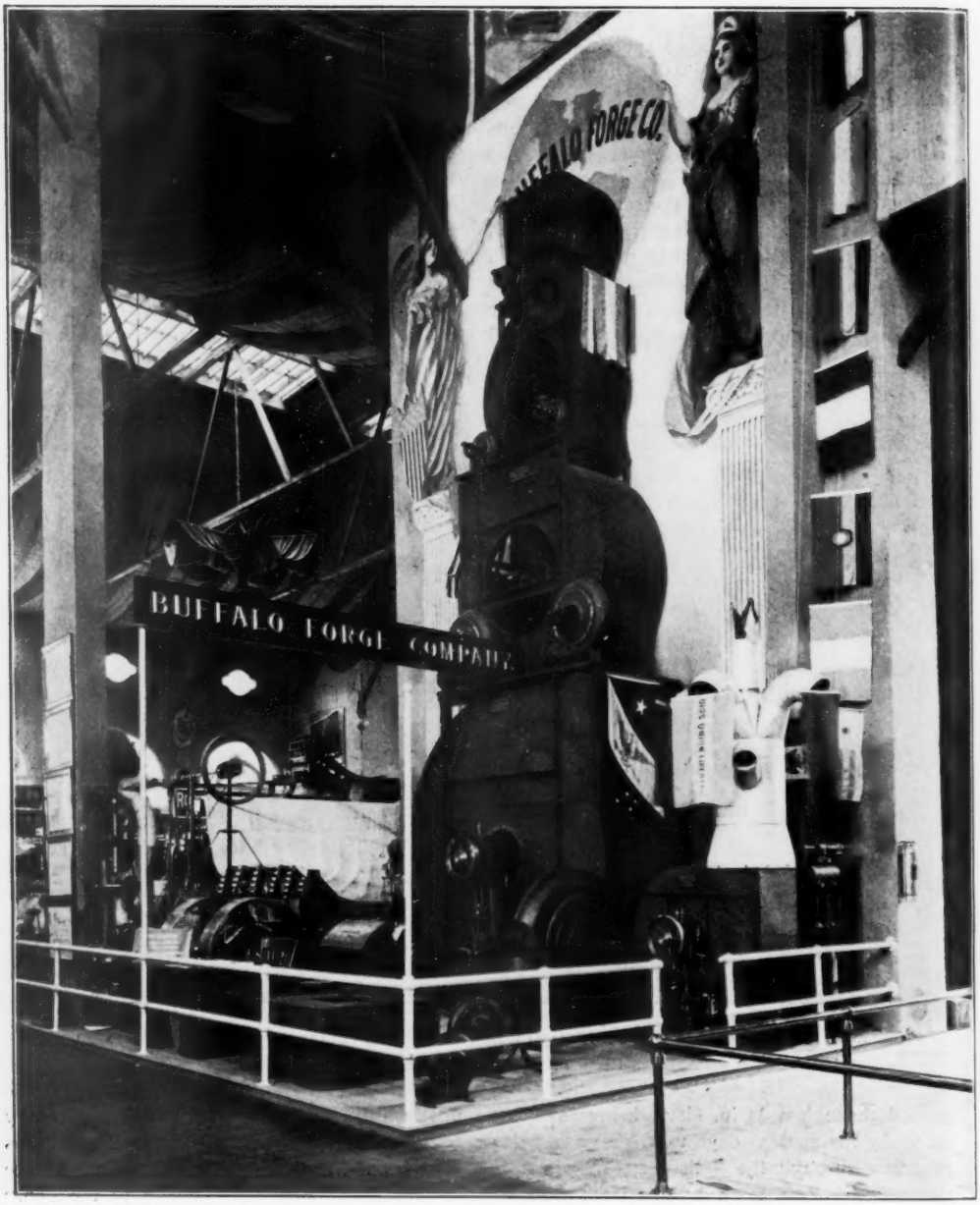
to contraction. The question of fluidity was got over by the addition of chemicals, and it was found possible to make the metal remain fluid in the molds for a sufficient time to permit of a comparatively slow solidification, which is often very advantageous; but of this hereafter.

The chief difficulty with the sand was to get it fine enough, and for this purpose that used for facing was dried and then passed through a 50-mesh sieve, the proportions being about two-thirds Charlton sand and one-third floor sand. After mixing, this was damped and passed through a ¼-in. sieve, being then put in a bin for several days to ensure a regular moisture through the bulk—a point which is desirable in fine work where no excess of water can be allowed. The molds were made in the ordinary way, the facing sand being sifted on to the patterns and backed with ordinary sand, special care being taken to vent the molds freely. The patterns being of such a character as to permit of this being done, the whole of the molds were slicked over with extremely fine plumbago, and when the castings were trimmed and brushed off, a perfectly smooth, polished surface was presented, and the castings could be drilled or filed anywhere. Needless to say, good molders were employed, and the boxes used were fitted, and not thrown together anyhow.

Coming to the metal, it was melted in 1-cwt. crucibles and poured as soon as ready, care being taken to skim off all dirt and sullage before pouring. Each crucible on being lifted had about 2 oz. of No. 5 ferro-sodium flux stirred into the metal, and as soon as the reaction ceased the pots were skimmed and poured, the metal in the runners and heads remaining fluid for a long time; but, of course, the molds were not opened until the castings were practically cold. Ferro-aluminium was carefully tried, but it did not give such good results as the previous flux, while chloride of manganese improved the metal; but owing to the dense fumes given off, it could not be fully tried in the place where the castings were made. From the results obtained, and from subsequent trials, this substance appears to be a good fluxing medium for iron, while as it only costs about twopence per pound, and as 2 oz. to the hundredweight of metal is sufficient, its use is not prohibitive. It is well to note that ferro-sodium is not now made, and that the Nos. 3, 4, 5, and 6 were never made outside the works of the late company, as these were secret proc-



A CASTING FROM THE C. B. & Q. FOUNDRY, AURORA, ILL. LENGTH 15 FT., WIDTH 9 FT. 6 IN., DEPTH 4 FT. 6 IN., WEIGHT 22,000 POUNDS.

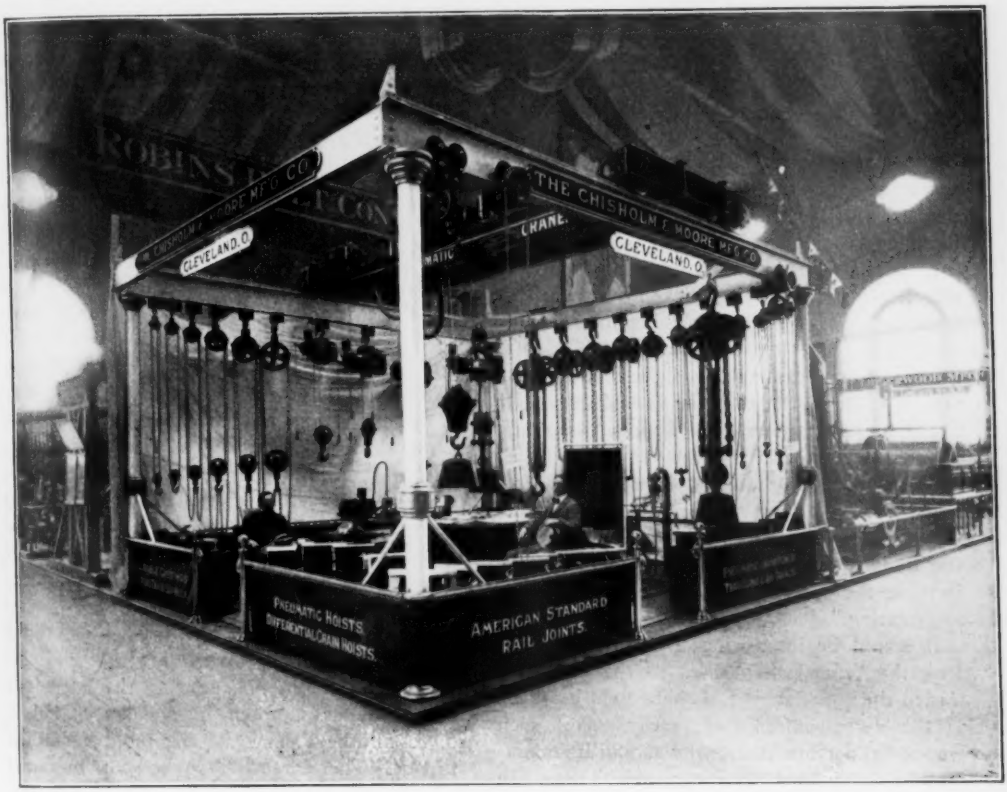


PAN-AMERICAN EXHIBIT OF THE BUFFALO FORGE CO.

ess manufactures, while it is quite safe to say that with Nos. 5 and 6 even the workmen only knew part of their contents. Ground fluorspar is not a bad flux, but a chloride is better than a fluoride as a rule, if rightly selected. In all fine work, good boxes which fit properly are needed, and both in lifting the copes and drawing the patterns great care must be used, as the molds should require as little mending as possible, mending too often destroying or injuring the face of the casting when made. For this reason, plate and machine molding, where absolutely correct lifts are made, proves more satisfactory than ordinary hand work with loose patterns, where absolutely good lifts are not always obtained.

The face of a casting can always be regulated by the facing sand used, and where a smooth, ungrained face has to be provided, a fine facing sand must be used, while a grained surface can be made with coarser sand or by using a dusting of some refractory material. Castings cleaned off by the sand blast will always have a better appearance than those the iron in melting, because this would alter its composition too much to make good work a certainty.

Where work of a well-paid character is being done, and the cost of melting can be borne, crucible melting gives the best results, as a greater control of the metal can be maintained. With light work, crucibles to hold about 1 cwt.



PAN-AMERICAN EXHIBIT OF THE CHISHOLM & MOORE MFG. CO.

cleaned by hand, and with a little care in manipulation the sand blast will make work quite smooth enough for any purpose to which cast iron is ever placed.

Of course, in making castings of unequal thicknesses, it is necessary to arrange for feeding the thick portions, or there is a great chance of getting "sink" holes—i. e., depressions on the upper face of the castings, caused by contraction of the metal during cooling; and if hard iron or poor scrap be used, there is always a chance of the thin parts cracking, and this renders the use of soft pig desirable. For fine work where the metal is melted in the cupola, coke free from sulphur should always be used, and care should be taken not to burn of metal are large enough, as each heat should be quickly poured; but if the castings are of a fair thickness, then pots of double the size will prove more economical in the way of fuel —that is, if the furnaces are well arranged and the draught is good. General work would not pay, however, for crucible melting, and a well-made cupola of not too large a capacity, and which melts rapidly, is desirable. Where such can be done, pouring all the afternoon is better than having a bulk of work to be poured in an hour or so, as this saves space and enables the molders to work without overcrowding, while with machine work a very little organization will easily do away with much heavy lifting, and the undue handling of boxes. Be-

sides, if a late shift of laborers be employed, the floor can be cleared up and everything be ready for the molders to start with a clear field of operations each morning—a point of considerable importance in a well-ordered foundry.

Where possible, light and fine iron molding should be done apart from the general work, and in many foundries it would pay to have a separate floor and cupola for this class of work.

* * * * * * * *

Castings one thirty-second of an inch in thickness or thinness, closely approach sheet metal, and if of fair size would certainly be difficult of casting. We do not know exactly to what use castings of this character could be put, but will take it for granted that they were intended for visiting cards.

A casting one thirty-second of an inch thick ought to peel after being slicked over with fine plumbago, but there is one thing to which we would call Mr. May's attention, and this is that a fine iron casting of a light character can not be made if the mold is slicked over with a tool or even gone over with a camel-hair brush. The molds for the finest castings that are made are not touched by a tool of any kind. If the casting requires the use of a facing to make it peel, the pattern is returned to the mold after the facing has been applied, forming the operation well known to molders as "punting."

It would be interesting to know just how long the "chemicals" added to the metal retarded the solidification of these light castings. If this ferro-sodium flux is capable of such wonderful performances, why should its manufacture have been discontinued? There are but few foundrymen who are rich enough to follow Mr. May's directions for "making" fine iron castings, and for this let us be thankful.

* * * * * * * *

A communication from Kenosha, Wis., says:

"The principal manufacturers of this city will endeavor to husband the labor supply by the formation of a novel union, which will eventually eliminate the floating element in labor by obtaining married men and inducing them to settle here permanently. The plan is to purchase a large tract of land on which will be built homes for 1,000 laborers. These homes will be sold to the men at actual cost of building. The move is made because of the scarcity of suitable labor and the fact that much of that at present available is of a floating description."

The best way for any manufacturing concern to obtain steady help is to pay good wages, wages higher than the majority in the same line of business pay, and to keep its works in continuous operation. Inducing a workman to buy a lot and then reducing his wages or giving him work only about half of the time, after he is believed to be anchored, will have but one effect, that of turning an otherwise first-class mechanic into a dissatisfied, growling servant, who will some day be desperate enough to let his house and lot go and seek more agreeable working conditions elsewhere.

Emergency Jobs.

While working in a small shop in Maine last winter, I met with an emergency job which was too much for the "old man." There was only one small cupola in the shop and the casting was a cheek piece for a stone crusher. The old casting sent in was half hard iron and half soft iron and the new casting was wanted to be made the same way in order that it could be machined. It was about 16 x 24 x 16 inches in size. The foreman and proprietor were both very anxious to make this casting, as there was a premium offered on the job, but to get 300 pounds of hard iron and 300 pounds of soft iron out of a 32-inch cupola at one heat to pour in the same mold was too much of a job for that shop. I suggested the melting of the hard iron in a large ladle by tapping the windpipe with a smaller one and pouring the hard iron into the mold and when this was set, or nearly so, to fill the balance of the mold from the furnace. The foreman laughed at me, and the job went elsewhere and I would just like to know whether I was right or wrong in my suggestion.

I notice on page 16 of the September issue of THE FOUNDRY a description of another broken down job, and believe that it could be made quicker by utilizing the old casting for a pattern and using a good, large flask or bedding it in the floor and using only a cope. After a parting is made at a level with the bottom, get some circular pieces of board cut to fit the lower edge of the casting. Bevel the inside edges and nail on two cross pieces as high as the pattern. For an ordinary sheave wheel, there should be about eight of these circular pieces to cover the circumference of the pattern. After driving a few nails, and clay washing these sections, on which the cheek of the mold is to be built, ram each up securely,

making a parting between each. After the cope has been rammed up and lifted off, dig up the mold behind these circular pieces down as far as the outer edge of the wooden pieces, also on each side of the cross pieces enough to get hold of them with the hands. Rap the pattern and draw the sections backward, when the pattern can be removed and the sections slid back into place. I will not give you any further details, as a practical man will readily understand the balance of the job.

R. W. BARRETT.

The Actual Cost of Castings.

In foundries where books are so kept as to only show the result at the end of the month or year, it is quite possible to make a large number of castings which cost more than they are sold for. This largely comes from the ruinous habits some shops have of charging a little less than the shop down the street. If these worthless jobs could be weeded out more money would be made out of less work. When the cost of making a casting has been figured up under fair conditions we know its actual cost. This is a much bettter basis to make bids on than to simply follow the custom of charging less than some one else. I will describe a method by which the actual cost of castings may be ascertained.

The books used are a foundry pad, two molding books, one core and cleaning book, one daily report book and one castings cost book.

The foundry pad is eight inches wide by twelve inches long, bound at the top, and has a stiff bottom cover. The pages are ruled and lettered on one side after the style shown in figure 1.

DATE, 4-23-01.

7	Smith and helper	1	
8	Finish'g pot & comp.base	2	
9	1 big cone	3	
10		4	
11		5	
7	Henderson..	1	
8	2 mouldings	2	
9		3	
10		4	
11		5	
7	Thompson	1	2 swages, No. 3.
8	2 corrugated arches..	2	
9		3	
10		4	
11		5	
7	Wilson	1	
8	5 small pan-mill screens	2	
9		3	
10		4	
11		5	
7	White	1	
8	2 plates with 3 ribs	2	
9		3	
10		4	
11	2 column bases, 14" x 14"	5	

FIG. 1. THE FOUNDRY PAD.

The molding books are ruled on both sides of the page as shown in figure 2. One page is for Mondays, Wednesdays, and Fridays, the other page for Tuesdays, Thursdays and Saturdays. The reason for this arrangement will be explained later.

DATE, April 23-01.

	Good.	Weight.
1 compressor base	1	439
1 flanged top pot		
1 big cone		
2 mouldings, 8' 0"		
2 corrugated arches..		
2 swages, No. 3		
5 small pan-mill screens		
2 plates with 3 ribs		
2 column bases, 14" x 14"		
6 concaves..		
1 furnace bottom plate		

FIG. 2. THE MOLDING BOOK.

The cores and cleaning book is a small one that will fit conveniently into the pocket. It should have flexible covers. The first half is for the cores, being ruled as shown in figure 3.

Articles.	Core Maker.	Time.	Sand.	Flour	Coke.
Engine frame	Anderson	5			
Comp'nd cylinder.	Kehoe	9			
			1300	120	185

FIG. 3. CORES AND CLEANING BOOK.

The last half is for the time it takes to clean up castings, when it is ruled as shown in figure 4.

Article.	Time.	Man.	Job No.	Purchaser.	S. P.

FIG. 4. CORES AND CLEANING BOOK.

The daily reports book should be about eight inches wide by fourteen inches long, ruled and lettered as shown in figure 5. The castings cost book is simply ruled for two money columns at the right.

CASTINGS MOLDED, April 23–01.

Molder.	Articles.	Time.	C. T.	Bad.	Good.
Smith.....	Finished com-				
Helper	pressor base. ...	10	2½	.....	439
....	Finished flanged				
.. ..	top pot	4	.....	.....	215
....	1 big cone.....	.....	3	.....	282
		14	5½	.....	936
Henderson	2 mouldings, 8" 0"	... ...	.....	.....	.....
		10	1	.....	364
Thompson.	2 corrug'ed arches	.....	.....	.....	186
....	2 swages, No. 3. ...	.....	2	.....	200
		10	2	.....	386
Wilson . .	4 small pan-mill				
....	screens	.....	.....	.....	209
....	1 small pan mill				
....	screen			52	.....
		10		52	209
White.....	2 plates with 3				
....	ribs..	.....	.....	.....	277
....	2 column bases				
....	14" x 14".....	.....	⅔	.....	182
		10	⅔	.....	459
Kittridge...	6 concaves.....	10	.....	.....	684
Oleson.....	1 casting.....	10	.....	.....	107
.. ..	1 furnace bottom				
....	plate	.....	.....	.....	64
....	2 furnace liners ...	.....	.....	.....	84
		20	..	.	939
Swift	8 halves top sec-				
....	tion casing	10	.....	.....	.....
Jones	....	10	.....	.....	.....
		50	....	.....	400

FIG. 5. DAILY REPORTS BOOK.

METHODS OF USING.

The first thing in the morning take note of everything that was not poured off the day before. At eight o'clock walk through the foundry with the foundry pad, write down the men's names and what they are working on. After number 7 put the molder's name and after number 8 write the name of the piece he is making. At nine o'clock go through the foundry again with the foundry pad, and, if any man has begun a new piece, write it down after number 9. Do the same at ten o'clock and so on at every hour.

If two or more men are on the same piece, put their names after number 7 and the piece after number 8. If a man has a helper with him, write "and helper" after his name. If you come across a pattern that has no name, or that you do not know the name of, make an outline sketch of it. When a molder is making several castings from the same pattern, write the name of the job down once when he first starts in, and do not write anything else in his space until he is given a new job. Then write the name of the new pattern after the hour when you first see him work on it.

Af four or five o'clock the blast goes on and then go through the foundry, and before the name of each piece write the number that have been molded. After the molds that are not finished write "N. P." for not poured.

In the molding book copy from the foundry pad the list of castings that were molded during the day. Give this book to the boss chipper, who will fill out in the proper columns the number of good castings and their weights. The next day fill out the other molding book and exchange with the boss chipper. As previously mentioned, two molding books are used, one for Mondays, Wednesdays and Fridays, the other for Tuesdays, Thursdays and Saturdays, and is to permit of these remaining in the chipper's hands on alternate days.

After filling out the molding book, write in the first half of the cores and cleaning book the names of the castings containing cores. In the last half write the names of the castings of which you desire to know the cost of cleaning. During one of the trips through the foundry ask the boss core-maker for the information required concerning core work of the previous day, and write this down in the proper columns. In the same way get the cleaning time from the boss chipper. The job number and purchaser's name are merely for reference and may be omitted.

The figuring up of the cost of molding is done on the first day, the cleaning on the second day, and the reports are written up on the third day. The daily report book will show the totals for each day. At the top of the page place the date on which the castings were molded. In the first column copy from the foundry pad the molders' names and in the second the articles molded during the day. In the column headed "Time," and opposite each man's name, place the number of hours that he worked in the column headed "C. T." Place the time it took to make cores for the castings in the column headed "Good." Copy from the molding book the weights of the good castings, then fill in the column for weights of bad castings. Draw two lines across the page between them, enter the totals, and in the same way proceed with the next man's work.

It will have been observed that the information necessary to properly fill out the castings cost book is found in the foundry pad, the molding books, and the cores and cleaning book.

The great value of a system of this kind is that it shows just what jobs are most profitable and which men do the most work. Such a set of books kept faithfully for one year and properly indexed is a library of facts that will always be appreciated, especially when one is about to make new bids. C. H. MELQMOND.

The Molder's Troubles.

The very interesting article of Mr. L. C. Jewett which you printed in a recent issue of THE FOUNDRY is certainly a picture of foundry life that no artist, except he be a sand artist, can fully appreciate. In the ordinary jobbing shop the poor sand artist is often compelled to transform himself into a patternmaker, an engineer, and the Lord only knows into what other labor-saving devices he has got to turn himself.

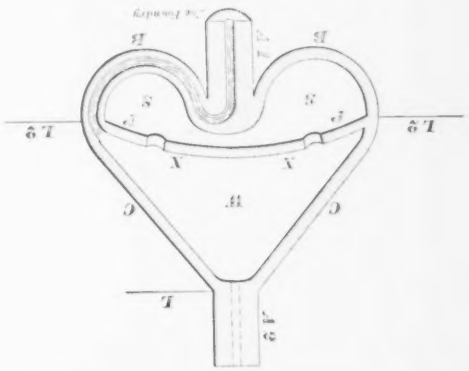
If the casting is N. G., or is rough, or is not exactly what it would have been if the proper pattern had been furnished, he gets a polite invitation to take a stroll into the chipping shed, where he is the recipient of a lecture which makes him wish he were in Cuba. I have seen patterns come into a foundry costly and well-made, when after a couple of castings had been made therefrom, the parties would want something else just like it, only not like it. They did not want to make a new pattern, and the one just used was too good to cut up and alter, so the molder is asked to cut off, fill up, build a corner here and round one off there as the case may be, and here is where the molder has a chance to show his constructive ability, and thus it goes from day to day.

Some years ago I was in charge of a shop that did a general line of manufacturing, among the output being a line of bark mills which were shipped to all parts of the world where trees grow and leather is tanned. These mills were sent to a section of the country where the bark used for the purpose of tanning was of a very resinous or sticky nature, which caused the mills to clog to such an extent as to make them almost useless. The Bark Mill Co., to hold their trade and give satisfaction, set out to devise a mill which would meet and overcome the difficulties presented by this troublesome bark.

The inventor of the mill made a drawing of what he required (which was easy on paper) and sent it into the foundry to be wrestled with there. It was decided to insert steam into the runner of the mill with the hope that, by keeping the teeth of the runner hot, it would soften the gum in the bark and keep them free and clean. As this was only an experiment, it would not pay to make any extensive rigging until it proved successful.

The sketch here shown (without the partition xx and the pipe leading through the hub A1 and the arm B) shows the runner as it is when made for a regular mill, except that it has graduated teeth set in rows which are not shown in the sketch. The patterns for these runners are in four parts, the upper and lower hubs, or journals, A1 and A2, the arm B, and the shell of the runner C. In making this casting for the regular or plain mill the method is as follows:

The shell of the pattern is placed on he follow-board and the cheek of the flask is rammed up and a parting made at the line L. The cope is then rammed up, the cope and cheek bolted together, and the whole rolled over, when a parting is made at the line L2,



after which the arms B are placed into position and the inside of the casting is rammed up and a parting made at the top of the arms. The bottom cope is then rammed up and lifted off, and the arms together with hub A1 are removed, the mold finished and cope replaced, and the whole flask turned over. The cope and cheek are then lifted off together, carrying along the shell C with the flask. After the pattern is drawn and the cheek finished, the hub A2 is drawn from the cope, when the flask is closed, bolted together, and ready for pouring.

This casting is somewhat of a job in itself, but to make it with the steam partition xx, and the pipe passing through the hub and arms, is quite another thing. The operation is the same as for the regular casting until it comes to the ramming up of the inside of the shell. A dry sand mixture is used to nearly the top of the shell C. It is then cut down with a strickle to the bottom line of the web xx. A parting is made, and thickness is then put on by using another strickle. The arms are then put in place and rammed up in a dry sand mixture and a parting made at the top of the arms as before; the cope is then put on and rammed up with the same mixture of sand, after which it is lifted off and hub A1 drawn. The mold

is dressed up and the whole thing put in the oven to dry, after which the pipe is put in its position and held there by wire nails or light chaplets. The cope is then put on and lifted off again, bringing with it the sand SS from between the arms and the parting PP, which is done by hooks or wire fastened to the rods in body of same and secured across the bars of the flask.

The thickness is then taken off, which makes the web xx. Four cores two and one-half inches in diameter act as passages from the dry sand W to the cope, and are also used to fasten hooks to the arbor in the parting W, and thus fasten it securely to the part SS and the lower cope. After the latter has been put on, the hooks are made fast and the whole flask turned over. The upper cope and cheek are then lifted off and knocked out, as it will be remembered that these were not rammed up in dry sand. The shell C is then slipped over the part on the floor, and the cheek and cope rammed up as in the first case.

The dotted lines in hub A2 indicate where a hole is drilled and a pipe inserted, through which the steam passes into the runner to keep the teeth hot, after which it passes out through the pipe down in the arm and hub into the waste pipe below. The two and one-half inch holes made in the web by the cores are plugged up after the entire core W has been removed through these four holes, from which it can be gathered that the arbors and rods used in this part of the core must be very light. Great difficulty was at first experienced to keep the pipe in the arm and hub from opening at the seams and thus letting iron into the pipe. This was later remedied by giving the pipe a good coating of glue water and parting sand, afterwards drying the whole. The inside of the pipe was filled with burnt parting sand, which was easily rapped out.

This steam runner proved to be a success for the purpose intended, yet, strange to say, the management could not be induced to make any change to simplify the molding of this casting, always giving as the reason "We might never make another one. It does not pay anyhow." This was fourteen or fifteen years ago, and I have been informed that they are still making these castings the same old way. To make the first casting was certainly a sticker.

I am not aware of any other trade where so much scheming must be done to achieve results as in the foundry, and where so little credit is given for the work accomplished.

Elizabeth, N. J. F. B. SHAFFER.

Feeding Castings.

In THE FOUNDRY for September there appears an article, well written, and illustrated, on the "built up" molding of a heavy pinion from the pen of R. H. Palmer. What I wish to criticise is his feeding device; he shows two feeding heads—both to be churned.

This arrangement is very defective, due probably to a lack of knowledge of the principles involved in feeding castings, which is very scarce among "sand tics," as I have observed for many years. No molder will dispute the proposition that iron can be fed through a four-inch head for a year, if it gets away fast enough to prevent setting. One feeder on a casting then is perfection, because it gives the fastest feed possible in the case, and keeps open the longest. If we add another, the feed in each will be half as fast as in one, and if six are used the settling of the metal will be reduced in each to one-sixth the speed of one head.

I don't claim that the arrangement of feeders shown will spoil the wheel, because they will feed it as well as they would feed two half wheels, cast separately; it depends largely on the extent of the casting, the amount of metal that will be drawn from the feeder, but it is still a mistake.

In THE FOUNDRY for April 1898, will be found an article treating this subject more extensively, showing losses by old experienced molders from this very blunder. One of the illustrations presents a large square shaft showing six feeding heads on top with a large shrink hole under each, and that mistake was made by a gifted man who had had 30 or 40 years of foundry experience. Is it not a fact that when molders use one feeder on a casting they do so because they think that practice is "good enough," and not because they recognize that as the true practice.

The molder who put six feeders on the square shaft evidently seized the first opportunity in his life to put that many on one casting. At the Niles & Co.'s works, away back in the fifties, we were making three-ton sugar rolls and steamboat cylinders in loam with cut-off, feeding-ring extensions about a foot high, and these always presented shrink blemishes, but not sufficiently serious to demand a change of practice, but I condemned it on the principle mentioned above In my 60 years of foundry experience I never found one molder who appeared to have reasoned out the true theory (and it is the perfection of sim-

plicity) that one feeder is perfection has the greatest feeding power, that every addition reduces the efficiency.

When we commenced the Shields engine, for the Cincinnati Water Works—100-inch cylinder, 46-inch pump, 12-foot stroke,—we were compelled o abandon that feeding practice. The first cast was a valve chamber, a nearly plain cylinder, 76-inch diameter, 4¼ inches thick, weighing several tons. It was fed with a full cut-off ring weighing nearly a ton, and may properly be called 40 heads, 14 inches wide, if partitioned off. The feed was a failure, a dozen rat holes were found under the cut-off ring; after a long parley it was accepted for top of the pump. I then adopted a feeding chamber equal to 8 inches square and 14 inches high, and of 600 tons of loam castings, weighing from 10 to over 20 tons each; all were fed perfectly sound by throwing away 39 heads and using one only.

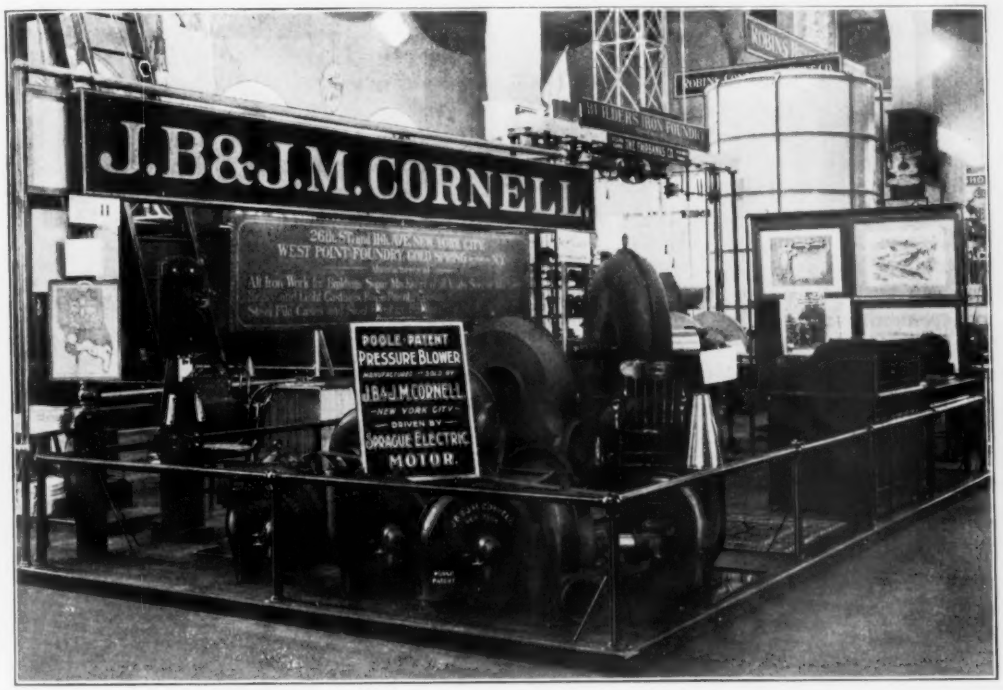
The molder will readily perceive that, aside from the perfection of the castings, a little "fortune" was saved on that long job, in brick walls, ramming and digging of less depth of pits, and melted iron.

MELTING AND RECOVERING CAST IRON BORINGS.

In the August FOUNDRY a new method of melting borings is reported that leaves us much in the dark about what kind of a furnace was employed, which would be interesting reading. They were melted by stirring them into a bath of melted iron. That is probably the only method that will preserve the softness, and loss by oxidation, neither of which can be realized by the cupola process, due to the exposure to the atmosphere at a high heat. The writer had an experience in melting many tons of borings in a cupola over 30 years ago, at the M. Greenwood foundry at Cincinnati, that may be of interest to your numerous readers.

The proprietor had purchased the right for melting in cast iron pots, so we made the first melting by charging in them, charging a ton after the regular heat and running it into pigs. The next day, the pigs showing white in the corners, we charged 1,600 of that iron with 600 of ordinary soft pig, which proved just soft enough in the mixture for turning.

Watching the charging of the pots I noticed that the first dropped into the soft hot bed all right, but the next struck it and cracked both,



PAN-AMERICAN EXHIBIT OF J. B. & J. M. CORNELL.

and so on. Probably not a pot of that ton charge escaped a break, but left it far more compact than if charged with a shovel. I was strongly impressed that the frailty and expense of the patent pots could be improved upon.

The next day I asked our teamster to find out what second-hand nail kegs could be got for, in quantity; he reported 1½ and 2 cents each. After that I charged in them successfully, filling them within two inches of full, then filling the remaining two inches with wet borings, ramming them smooth and concave, and leaving them a few days to rust a hard head in the keg.

I never "weighed up" to ascertain the loss in melting, but it was small, as I was astonished at the yield in many meltings. With borings worth only about $3.00 a ton, and castings wanted that do not require tooling, and when iron can be used at first melting, it certainly looks tempting to melt them in this manner. The only drawback is the swear words heard mumbled by the "down stairs" Henry on seeing the extra crop of slag on dropping the cupola bottom. R. D. MOORE.

Amateur Molders.

In the August issue of THE FOUNDRY there is an article written by John M. Richardson on Pattern Making and Pipe Work, and you fall into the common error of publishing this without comment.

I would call your attention to the utter impossibility and impracticability of spreading newspaper or in fact paper of any kind, even tissue paper, to act as parting sand on such curved and irregular surfaces as his article describes, or, in fact, any curved surface other than plain cylinders, as it is a self-evident fact that paper, however thin, will not lay without wrinkling, even on a cone, unless specially cut to meet conditions, and it does not require a long stretch of the imagination to see what would happen if one were to follow Mr. Richardson's directions in the newspaper line, and get himself in all kinds of trouble trying to make the news of the day conform to shapes and corners totally unfit for publications of any kind.

In the same issue there is another article with sketches, written by R. H. Palmer, who endeavors to describe a "bedding in" job on an engine sub-base or sole-plate. He tells us how, after digging the pit and laying the cinder bed at bottom, over which he rams sand to the required height, then a light coating of sand is riddled on so as to lay pattern on same to get an impression, whereby he can dig out to shape, after removing pattern of course, and again riddling about ⅝ inches of sand, he raps the pattern down about ¼ inch, which we are to assume is the height of the so called chipping strips or, more properly speaking, finish pads. All this is perfectly lovely from an amateur standpoint, but I wonder if he ever thought of having the finish pads loose from pattern with strips on the back fastened by screws, thus giving their accurate relative position and enabling the molder to strike a level bed at bottom of pit to lay same on to ram up to height of pads only, and after removing strips he strikes off once more flush with top of pads and places pattern on same, the matching dowel holes in pads giving the correct position to pattern body, and obviously there will be no necessity for all the extra work described, especially that unpardonable sin of rapping down so large a pattern ¼ inch, which simply cannot be done properly in the manner described and always results in damage to the pattern and a very poor and distorted casting.

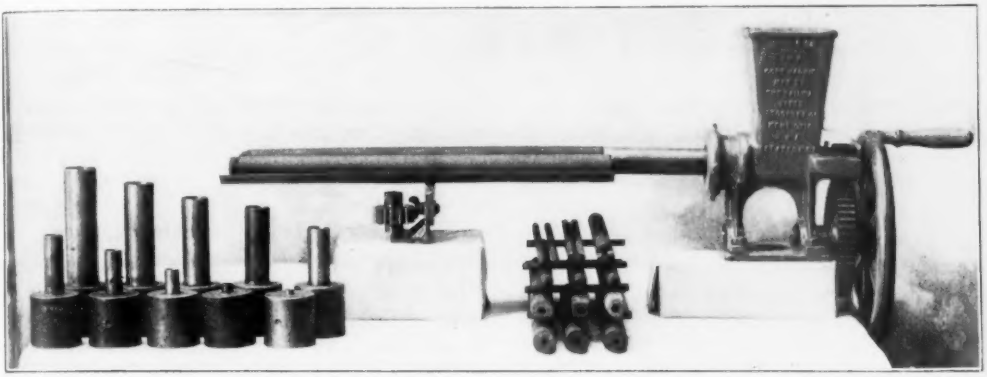
Brooklyn, N. Y. PATTERNMAKER.

(Were it not for the fact that in our own experience we have used newspapers on a great many occasions in place of parting sand, we might be tempted to let the criticisms of "Patternmaker" pass unnoticed. With a little wider experience on his part he would probably not think it unmechanical to use paper for this purpose. There are a great many surfaces on the parting of molds where it is extremely difficult to apply parting sand. As for his opinion that it is not practical to make newspapers fit irregular surfaces, we would call his attention to the fact that the tailor has no difficulty in cutting a piece of cloth to fit the very irregular outline of a man, and why it should be any more difficult to make a paper fit the parting of a mold is not clear.

The criticism of our friend from Brooklyn of Mr. Palmer's method of bedding in a pattern may or may not be well founded. It is to be remembered that all patterns which are bedded in are not made by the patternmaker with this object in view. Mr. Palmer's description shows how the job was done; not how it could be done. The ideal is hardly ever reached in foundry practice, and we are of the opinion that patterns will continue to be rapped down, no matter if this practice does shorten the life and brings with it other evils. The molder who is expected to get up a day's work will not be very particular about etiquette towards patterns as long as his boss insists that he must hustle.—ED.)

The Wadsworth & Sherwin Improved Core Machine.

This is a machine for making cores on the continuous plan, the sand being compressed and fed through a die having an opening of the proper diameter, by means of a differential screw. As the core is formed in the die it is at the same time provided with a centrally located vent hole, something which every coremaker will acknowledge is difficult to accomplish by hand work. In addition to this much more perfect cores are turned out than would be possible with split core boxes or pasted cores. The manufacturers state that a hundred and twenty feet of core can be made per hour with one of these machines. As the cores are in one piece they occupy less space in the core oven and the handling of extra core plates is avoided. There is also less breakage of cores than is the case where cores are made in halves and pasted together, and needless to say, there can be no loss of castings through the iron finding its way into the vent. The Railway Speed Recorder Co. of Kent, Ohio, are the manufacturers of the Wadsworth & Sherwin core machine.



THE WADSWORTH & SHERWIN CORE MACHINE.

Cast-Iron and Steel-Tired Wheels.

Taking up some of the questions involved in producing cast iron car wheels for heavy capacity cars, Charles V. Slocum, president of the Keystone Car Wheel Co. of Pittsburg, says in a letter to the *Railway Age*.

At the present time cast iron car wheels are, almost without exception, made upon specifications as to outlines, internal construction, etc., as laid down by the railroad companies. Among other things a weight is specified, and this weight invariably is 100 to 500 pounds lighter than any steel-tired wheel permitted in regular railroad service.

It goes without saying that the wear and strain upon a car wheel will be very severe when subjected to carry one-eighth of the load of 100,000 to 110,000 pounds of freight, and an additional 35,000 pounds of car, or a matter of about nine tons per wheel.

No one has as yet advanced a satisfactory reason why the great difference in weight between the cast-iron wheel and its steel-tired competitor should be permitted. Railroad men have assured me that a steel-tired wheel weighing 600 pounds would not be considered safe even in freight service, yet by far the greater proportion of cast-iron wheels in service do not weigh over 600 pounds.

I think the officials in the mechanical departments will admit that the facts are substantially as follows: For 33-inch wheels the steel tires alone weigh 600 to 900 pounds, unfinished and without hub and plate. The heaviest cast-iron wheel must not weigh over 650 pounds complete ready for service. Again, the steel-tired wheel begins with a price of about four cents per pound for the rough tire alone, without any finishing, which means without machine turning the tread or flange, without the cost of the casting for the plate and hub, and without any bolting or shrinking on of tire to plate; in other words, a cost all told of $35 to $65 per steel wheel, so called. The cast-iron wheel can be bought anywhere at 1½ cents per pound finished, or less than $10 per wheel.

I venture the prediction that before the rail-

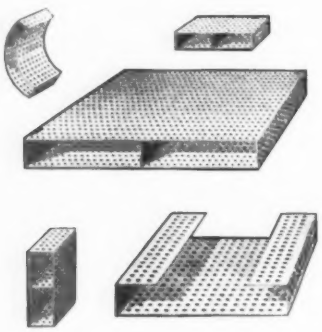
roads will pay this difference of 300 to 600 per cent for wheels for heavy freight service, the manufacturers of chilled wheels will be given an opportunity to supply heavier wheels than now permitted, and at better prices than now prevailing.

It is an almost unheard-of thing for the railroad official to say to the manufacturer: "Build for us a wheel according to the best modern ideas and according to the best results of your practice and your experience, and which will give the best results in heavy freight service or under the 100,000-pound capacity car." Far from it. The specifications almost without exception demand a wheel made rigidly to certain well-defined lines, which have not varied materially in years. The manufacturer deviates or ventures an improvement only at the risk of rejection of every wheel so made.

The tests and inspection are made more severe every year with the intention of securing better wheels, and the result desired is obtained in a degree, but by no means to the fullest possible extent, because of restrictions and limitations previous to inspection. What manufacturer of cast-iron wheels would not be willing to make and guarantee wheels for heaviest service if paid two cents per pound for his product? Compare this with, say, five cents per pound for a steel substitute.

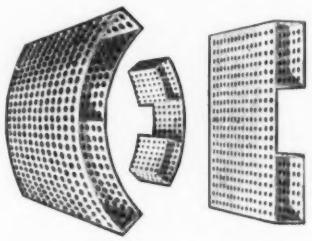
The Peerless Perforated Chaplet.

We all know that objection exists to the use of chaplets wherever it is possible to avoid



THE PEERLESS CHAPLET.

them. This is as much on account of the lack of union which is likely to exist between the chaplet and the metal which surrounds it as to the marred appearance of the casting. By the use of the perforated chaplets herewith shown most of these objections are overcome; especially is this the case where special castings are made when a chaplet to fit the outline of core and mold may be easily obtained. These chaplets can be made in any size or shape and



THE PEERLESS CHAPLET.

have already found much favor among foundrymen. The Hill & Griffith Co. of Cincinnati, Ohio, are the selling agents.

Not Large, But a Plan Developer.

It wasn't a nice job, there wasn't anything in it from a financial standpoint. Just one of those little accommodation jobs that comes to job shops and in which the chief value lies in the advertising that the fellow who gets it gives in explaining about it. There are two sides to this part of it, too, as it may bring in some more very mean sort of jobs.

The one of which I speak was just the section of a small gear.

It belonged to an old machine which was in good condition except for this gear, but which was old enough that to get another gear from the place the machine was made was not practical, indeed it was questionable whether the firm that made it was still in existence.

The whole gear was not more than a foot in diameter and the teeth were rather fine.

The piece that was brought down was perhaps the sixth of the circumference, two arms and part of the hub, with fortunately a little more than one-half of the hole in it.

A cheap pattern could hardly be made to hold together, while a good one would cost too much, but the job rather put the foreman on his mettle and he determined to have a try at it. So he selected a flask and measuring the depth of the drag, started for the pattern shop, taking a bottom board along and also the piece of gear.

The patternmaker soon had a round piece the size of the hole in the gear and as long as the depth of the drag, standing in the center of the bottom board and held by a screw. A small hole in the center of the other end just suited a brad that made a spindle for the

small sweeps, two of which were made, the one was just a flat piece cut back so as to just fill in the space from the arms up and one end extend over the hub and the other over the rim and a hole for the brad was put where the center of the hole in the gear came.

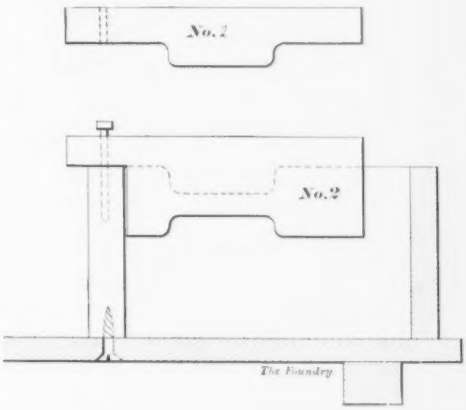
The other sweep was made to fit onto this, making a pair, or male and female. It was made so when set on the brad it swept out as far down as the thickness of the gear and about 1 inch farther out. This finished the patternmaker's part of the job and took about 20 minutes.

To mold the gear the drag was first rammed and struck off, the first sweep put on and the mold swept up. The cope was then put on and rammed up on this, to form the first side. The drag was again filled up and the second sweep used. It is now evident that a mold was had that would let a gear lie in, only it would have a web center instead of arms and be two inches larger in diameter and without any teeth. So far the job is one any molder used to sweeps would readily undertake. The fine work was yet to come.

Laying the piece of gear in the drag with the hole over the round upright the section of teeth were carefully tucked and rammed up level and the piece withdrawn with as little rapping as possible. Moving it around the spindle it was again laid in the mold, but with a few of the end teeth going into the teeth already molded, and just here is where the care and good judgment came in, to get the piece down without damaging the teeth already made and then so placing it that it was not crowding either way, for it is very evident that a very little crowding each time would be a serious matter when the last time to go in occurred. To the satisfaction of those interested the teeth matched up finely, so well, indeed, that an examination of the casting did not show where the last work was done. A small slab core furnished pieces to lay in the mold and let the spaces between form the arms which were left with square corners. The screw was easily taken out, allowing the sweep stand to be withdrawn and the hole filled up to the hub, which was left without a core.

The time taken by the molder was about an hour, and when the machine shop put a hole in the center and a set screw to hold it on to the shaft, the owner of the machine was sent away happy and freed from the fear of having to throw the whole machine away for want of a small gear and the molder's magic.

A brief examination of the sketch will make it all plain. No. 1 sweep was used first and the dotted lines on No. 2 show the shape No. 1 would make in connection with it.



The men in the shop were as much interested as over many much larger jobs, as most of them thought the job impossible without a pattern.

W. OSBORNE.

Are Good Molders Scarce?

In the August issue of THE FOUNDRY Mr. Shaffer asked this question. There is no doubt of the scarcity of skilled workmen. It was ever thus, and no doubt it will continue to be so, as the demand for skill will always keep in advance of the supply.

It is one of nature's inexorable laws. The value of gold is due to its rarity. The skilled molder is an artist, and is as rare as a skilled portrait painter, sculptor or a musician. With these, as with all artisans, there are some of mediocre qualities. These are botches as Mr. Shaffer terms it. It is a pity this is true, but people will continue to mistake their calling. The botch in the foundry might be a howling success at some other calling for which his talents are fitted.

Once upon assuming charge of a foundry, I discovered two youngsters therein who were rated as apprentices. Always having an interest in any one who is trying to learn, I kept pretty close watch of these two, and soon learned that neither were adapted to the foundry business. As soon as I felt sure that there was nothing to build upon, it occurred to me that it was my duty to undeceive these two young men.

One day I took the lads into my confidence, and, as kindly as possible, explained to them what were the requisites necessary to become a

good molder. I pointed out to them where they fell short, and that it did not follow at all that they would fail at some other trade. They were requested to take a couple of weeks off, hold a heart to heart talk with their parents, and to try to get into something more in accord with their talents, if talents they had any.

In two weeks they returned and said they wanted to serve their time out. As they had then put in nearly two years I felt it was hard to have them lose all this. Everything was done in providing them with opportunities. Instructions galore were given them, but all to no purpose.

They were good boys, as the term goes, and sometimes I thought they were too blamed good. I would have been pleased to have seen them break something, but no, they could not catch on to the mental side of molding—the thinkable side. They finally found a level driving dump carts.

There are two distinct sides to the art of molding: the mental and the muscular. To produce the skilled artist, these two characteristics must be present in just the right proportions. Of course it is rare to find this happy combination among those who gravitate to a foundry.

The cold, frigid fact is that there is nothing about the foundry to attract the youth of brains toward it. Brains will easily find a better market and better surroundings than the foundry offers with its varying temperatures and smoky interior, clumsy tools, etc.

I do not think as much depends upon the opportunities offered in the shop to mold different classes of work as it is customary to ascribe thereto. The best and surest heavy machinery, green sand molder I ever saw started as a buck in a stove plate foundry and never served an apprenticeship. I have taken men right off snap flask and bench work and put them on heavy crane work and there was no mistake made. There are those who can absorb knowledge up to a certain point and more cannot be forced into them. Some do not want to know any more, or, as a friend of mine once said, "They don't know anything, and they are d—n glad of it."

I once had an experience with a lot of molders that convinced me that those really skilled in the art will ever be brilliant stars. The meetings of the union had become humdrum affairs. Interest was certainly on the wane and the attendance was falling off. I asked the members present at the meeting how many could on the morrow take off a heat successfully from their cupolas. No answers. How many understood or could run a cupola. No answers. I then proposed, if agreeable, reading three papers before the union, describing the latest practice of running a cupola. Upon putting the question it received an arousing aye. Returning home I felt reason for self-congratulation. I had found a means at last to edify the members and revive their waning interests. Here is what the unions could do. They could exchange ideas with one another to the advantage of all.

The reading of the first paper was not half through when the audience began leaving the meeting. At the conclusion—it occupied about a half hour—there were but ten of us left out of thirty-five. At the reading of the second paper every member but the officers withdrew before it was finished. There was not a question asked, a remark or criticism made. The third paper was never read, and no one was interested enough to ask why. They did not care to know why it was omitted. Their brain capacity was filled; what gray matter they had was absorbed in base ball, politics, or something of that kind.

Once in a long while the making of a molder wanders into a foundry. "Mr. Foreman, is there a chance for an apprentice in this shop?" Turning around there stood a bright-eyed young fellow, neatly dressed, with a confident air. "Have you ever been in a foundry from time of commencing until the close of a day, so that you could form an idea as to what a molder's work is?" I asked him. He had not, so I asked him to come down the next morning when he could see a foundry from start to finish. I advised him to study the matter for a few days, talk it over with his parents, and if, at the end of the week, he still thought this was the business he desired to enter and one in which he would take pride, to come back and we would do our best for him.

That young man has now been a successful foundry foreman for more than six years. He was not tutored much, but was always ahead and alert. He was given every opportunity of course, as all apprentices should have, but really he was not given as much attention as is sometimes advocated for apprentices, and there was no undue enlargement of his cranium, either. He certainly was a star.

L. C. JEWETT.

Dovetail Lore.

To dovetail a loose piece on a pattern is a simple enough job and is often preferable to draw pins, if made properly, the type mostly used, however, has this disadvantage, that of being so formed that the sand clogs and builds up at bottom so that after being in use a short time the loose piece is forced out of its correct position to such an extent that frequent cleaning and scraping is necessary to secure even approximately the proper location it originally occupied.

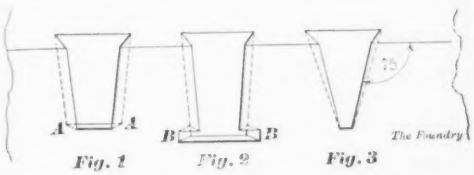


Fig. 1 *Fig. 2* *Fig. 3*

The sketch shows two ways of avoiding these little annoyances. Fig. 1 is the old style type with the troublesome pocket at bottom marked AA. Fig. 2 shows similar dovetail with two cuts BB made in line with bottom with an ⅛-inch chisel to form a runout, which makes it practically self-cleaning by destroying the pocket, thus permitting the sand to fall out between times. Fig. 3 illustrates another form that is positively self-cleaning, as there is no bottom for the sand to lodge. This dovetail is made with three cuts of a hand saw, two for sides and one for center, to prevent chips from becoming wedged when using the firmer chisel to form the back; in making this style of dovetail cut sides to at least 75-degree angle, as a better, accurate and more durable bearing will result.

LYCOPODIUM.

Lycopodium is a vegetable powder used by pyrotechnists and theatrical mechanics to produce a lightning-like flash effect sometimes needed in their business, and by druggists to sprinkle on pills, not otherwise coated, to prevent same from adhering to one another, and the purpose of this letter is to advise founders to use it for the same reason that the druggist does, only in a slightly different manner and on very dissimilar material.

I refer to its use by a few founders in the East here to prevent the sand from clinging to patterns, both wood and metal, especially on molding machine work, and were it not that the few founders referred to regard their knowledge of it as a dark secret to be jealously guarded from competitors, and are not broad enough in their views to exchange ideas with their fellow foundrymen, this letter had better remain unwritten.

By the use of lycopodium, patterns that are considered nasty to draw are rendered by a very light sprinkling from the dust bag containing this chemical, as easy to mold as the proverbial sashweight. It will be found invaluable as a means for drawing in loose pieces on big work, as practically no rapping is necessary, the piece fairly jumping out as a result of the least jar. For getting the best finish on names and numbers that are made of the usual lead pattern letters and figures and fastened on so that they only touch the pattern in spots, leaving open joints underneath for the sand to stick in and thus mar what would otherwise be a fine job, lycopodium is as the Balm of Gilead to the heartsick founder who is tired of having castings sent back, because an A was made to look more like a Z by these very conditions.

On large work it is sometimes used when there is a deep draw with little if any draft, and to make it stick on the vertical sides or faces, some founders spray gasoline or naphtha on the pattern. Before evaporation on the one hand and capillary attraction on the other claims the oil as its own, "lyco" is sprinkled on so that it "cakes," and by this method you can riddle or shovel sand into the mold without fear of displacing this dust that has a specific gravity of only .5.

I am not prepared to guarantee long life to the pattern that has been treated in this manner, but from observation it does not seem to have permanently injured any pattern subjected to this rather heroic oil bath.

In core-making it can be used to great advantage under similar conditions as described, but it would be well to bear in mind that it loses its quality as a lubricant by being exposed too long to the action of damp sand.

Send the "cub" to the nearest drug store for a nickel's worth and put it in a bag made of goods not too loosely woven and give it a "try," at least, on your molding machine patterns, and I think you'll like it, and you needn't be afraid of an explosion or rumpus of any kind, when the hot metal strikes it, due to its pill-separating and lightning-producing qualities, even in conjunction with gasoline or naphtha, as there is absolutely no danger.

PATTERNMAKER.

J. Thompson, of J. Thompson & Co., Philadelphia, and the general treasurer of the Philadelphia Foundrymen's Association, is making a trip to the Pacific Coast for his health.

Brass Scrap.

BY C. VICKERS.

In the process of turning and finishing brass castings, considerable quantities of chips are produced which have to be used up by the brass founder. If these chips were always clean, their disposal would not present serious difficulties; but, however careful the finisher may be, the chips always contain some iron, which must be removed before melting. This is effected by hand magnets or by magnetic machines. In any case, the iron or steel is only partially removed, as the more minute particles are very successful in eluding the magnets, and if the metal when so cleaned is used for small castings that are to be rapidly machined, the presence of these small particles of iron becomes a serious matter, because they do not melt and alloy with the brass, but are held in suspension and are distributed by the stirring, skimming and pouring throughout the metal, and are found imbedded in the castings in small specks of extreme hardness, and when these specks come into contact with a delicate tool, that tool will suffer, if it is not utterly ruined. The loss is often serious, as in many cases the tool has been made especially for the particular job and would have lasted the job out if the metal had been clean and soft.

When it is necessary to use chips in small castings, chemical means can be resorted to, to remove the finer particles of iron. They may be rusted out by mixing the chips with salt, wetting with water, letting stand for a few days and then washing in running water. A quicker, and by some claimed a better way, is to first remove grease either by burning or by the use of lye or common soda, and afterward to boil the turnings in a strong solution of alum.

If the founder is making castings of a low grade, with little machine work on them, the disposal of chips is an easy matter, as, after the bulk of the iron has been removed by magnets, they are clean enough for his purpose. His trouble is merely one of melting. There are several methods of disposing of this difficulty. In some shops the furnace-tender and his helper will occasionally work evenings or on Sunday, running the chips into ingots. Another plan is to fill up the worn-out crucibles with borings and set them in the fire all night after the regular heats are out, throw in a little fuel, open the drafts, and leave until morning, when the crucibles are broken open and the metal is obtained in the shape of a "heel." Still another method is to put a given quantity of chips in every pot when charging.

In pouring metal, it is not always possible to avoid spilling some; if this spilled brass is not promptly cared for it becomes a source of loss. Although it may not be convenient to sweep the shop oftener than once a week, the larger pieces of brass should be collected every morning and used up during the day. The sweepings should be sieved to remove the brass, which is washed, cleaned of iron and promptly used up. The sand may be used in core-making or thrown away, according to circumstances.

Considerable is lost by abrasion on emery wheels. This is difficult to utilize, as it is intimately mixed with emery. Owing to this, it is not easy to melt and is often allowed to accumulate, until its disposal becomes a serious problem. Unless it is saved for a definite purpose, it should be constantly used up by putting a little in each pot. Some firms use this dust in making thimbles for plumbers and save it for that purpose, mixing it with other scrap metal. If it is allowed to accumulate in any quantity, it is best to dispose of it to the smelter.

Another thing that will bear constant watching is the hearth on which the pots are skimmed. It ought to be cleaned every morning, the ashes being sieved and all cleaned metal and coke picked out. The residue is used to pack among the castings in the tumbling barrel, where it helps to polish the castings and is itself cleaned in the process. When it has become bright and clean, it should be picked over and the iron and clinkers removed, after which it may be divided among new metal or run into ingots.

Old crucibles should be broken up and cleaned of the metal adhering to the sides, and when the ashes are removed from the furnaces all the clinkers and pieces of brass are picked out. The clinkers ought to be pulverized, by tumbling dry, with heavy pieces of iron, and the resulting dust sieved to recover the brass, which is generally found in the form of small shot.

Aluminum should be skimmed on a separate hearth and the skimmings cared for separately, for if mixed with the brass it causes discoloration.

Pan-American Exhibit of Rogers, Brown & Co.

Rogers, Brown & Company at the Pan-American Exposition have made what is prob-

ably the most extensive display of pig iron which has ever been shown at any recent exposition at home or abroad.

They have made a departure from the usual method of displaying samples of various brands of pig iron, by attempting an educational exhibit intended to interest the casual observer as well as the experienced consumer of pig iron or the man technical in blast furnace practice.

To this end, they, in many instances, have shown the ores, fuel and limestone used to produce the pig iron, with descriptions of the ore mixture, showing in the same cases raw materials, the resultant pig iron in its various grades and samples of the finished product into which the iron has entered. In this manner, iron ores and pig iron samples have been collected from almost every state in the Union in which pig iron is made, all of them brands which are sold by Rogers, Brown & Company.

Interesting examples are the grouping of the red and brown ores upon which the iron business of the South has been built, surrounding which are samples of various prominent southern brands, also the old-time limestone and block ores which were the foundation of this industry in the Hanging Rock fields of Ohio which, for years, made the principal foundry iron consumed in the West. Alongside are found the brands in which this ore is still incorporated at such furnaces as the Hamilton, Belfont, Wellston, etc. A representative collection of Lake Superior ores used in the manufacture of Northern brands is grouped in cases with the best-known brands of Northern coke and charcoal metal.

The most showy and complete display of the exhibit is furnished by the Niagara and Tonawanda Furnaces near Buffalo and the Iroquois at Chicago. These brands show many interesting castings and bars of wrought iron made from their product. Notable among these is a handsome two-edged sword made by Rathbone, Sard & Co. from a mixture of "Niagara," "Tonawanda Scotch" and "Mannie" pig irons. The edges are ground sharp and true as a Damascus blade, showing no flaw in their entire length and a clean, close texture resembling steel. The same firm made for this exhibit, out of the same mixture which is regularly used in their works, art plaques of particularly fine finish, and a curious spiral spring of cast iron, remarkably showing the fluidity of a mixture that would flow through a tortuous channel of this sort not more than a quarter of an inch in diameter, at the same time exhibiting the elasticity and strength of the metal itself. A polished cone nearby displays the cleanliness and fine grain of these irons. The American Radiator Co. have also furnished for this display some extremely fine art plaques showing clean-cut ornamentation and smoothness of surface. Some fancy bending and twisting of cold bars puddled from all "Niagara" iron are furnished by the Rome Merchant Iron Mill, while the Long Foundry Co. of Rochester contribute some shavings, each 120 inches long and 2 inches wide, taken without a break in their length by a planer from a casting made from "Niagara," Lake Superior charcoal and scrap. The Iroquois Furnace of Chicago supplies in addition to its handsome line of pig iron samples a piano frame made by a Chicago manufacturer and several art plaques made by the Chicago Hardware Foundry Co. from this brand.

The Hinkle Lake Superior charcoal and the Rome, Cherokee and other well-known Southern brands of charcoal iron are in close proximity, affording a comparison of the qualities from these widely separated districts.

The Chicago World's Fair medal and a facsimile of the medal won at the Paris Exposition suggest past successes of the firm in other competitions. The display occupies a portion of the New York State section in the Mines Building. The firm has issued a map of the Exposition Grounds, with the location of their exhibit marked thereon, which they distribute to their customers and friends.

White Brasses.

In an earlier article the brasses or yellow metals were dealt with. It is here proposed to give a short account of the white brasses which though of smaller industrial application are used to a certain extent in the arts. If we take a yellow metal and gradually increase the content of zinc the yellow color will be replaced by white in the ratio of the increase of zinc. An alloy containing 45 per cent copper and 55 per cent zinc is nearly silver white in color. With increasing zinc and decreasing copper, a bluish grey color is assumed, until with a higher content of zinc the color of the alloy resembles that metal. The fractures of the silver white alloys are conchoidal, whilst those of the more zinciferous alloys are crystalline. All these alloys are of course too brittle for commercial castings; they are, however, used fairly extensively for ornament and figure casting in sand or chill molds. Some varieties

of these alloys will admit of pressing, and articles such as fancy buttons, etc., cast in chills have their detail brought into greater relief by this method. A series of such alloys are given:

	1.	2.	3.
Copper	46 per cent	43 per cent	20 per cent
Zinc	54 per cent	57 per cent	80 per cent

A method adopted for casting small figures, busts or statuettes in chills is to fill the mold with one of the above or following alloys, and when the surface skin has solidified, to turn the mold on end and drain out the interior. Many cheap bronze figures are turned out by the score by this method. The articles are artificially bronzed and brought into the market as cast bronze. Sorel's alloys admit of treatment in this manner, and the range in composition is given: Copper, 1 to 10 per cent; zinc, 98 to 80 per cent; iron, 1 to 10 per cent.

The best plan of alloying the iron is that recommended in the case of Aich or Sterro metal, viz.: To saturate zinc with iron and use this as a means of introducing iron into the alloy.

Further varieties of these alloys which cast well in chills and leave the mold with a fine clean skin are shown:

	1	2	3	4	5
Copper	10	4	9	7	10
Zinc	88	88	90	90	90
Iron	1	6	..	3	..
Lead	1	2	1	..	.

ANTIFRICTION METALS.

The trend of modern high speed engine construction is to use a bearing, the foundation of which is of brass, bronze, steel or iron, and the bearing surface a renewable lining of comparatively soft white metal. This white metal has a low melting point, and the worn surface of a bearing can be readily melted out and a new lining put in. Before lining, the bushes are cleaned by sand blast or acid pickle, and tinned to insure better contact of the lining metal. Making up these white metal alloys and lining the bearings is part and parcel of a brass foundry's daily routine, and hence a note on the composition of a few typical alloys may not be out of place. The requirements these alloys have to meet may be summed up as follows: 1. That they should readily melt and cast. 2. Be durable and offer little resistance to the revolving shaft. 3. Not be unduly heated by friction. 4. Not cut the journals. 5. Be sufficiently soft to adapt themselves readily to the bearing surfaces. Varieties of these alloys are shown in the following table:

	Copper per cent	Tin per cent	Antimony per cent	Zinc per cent	Arsenic per cent	Lead per cent
1	5.5	86	8.5	.....	.....	.....
2	7	85	8	.....	.....	.....
3	8.5	83	8.5	.....	.....	.....
4	9	73	18	.....	.....	.....
5	.....	40	6	.....	.....	54
6	.....	20	12	68	.....	.....
7	.....	21	9.5	.....	.5	69
8	....	43	1	.....	.....	56

Numbers 1, 2 and 3 represent the better qualities, and though expensive give in practice excellent results. No. 3 is used for large main bearings, whilst 5 and 6 represent cheaper types. No. 7 is a packing metal and in the form of cast rings is used for piston rod packing.

These alloys are made up and cast into ingots first, which may be remelted as required in iron pots or ordinary hand ladles. When making up a composition containing copper, antimony and tin, the metals should be alloyed in the order given, that is to say, melt the copper first, add the antimony and then the tin and cast into suitable ingot molds. When remelting care must be taken not to overheat. The appearance of the molten alloy should resemble that of quicksilver and should not on any account appear at all red.

PERCY LONGMUIR.

Making Valve Wheels with Steel Cores.

In small castings requiring a square hole instead of a round one the use of an iron or steel core will produce better results than sand cores. This is because the latter are very liable to have their edges slightly worn through handling and whereas a drill or reamer will easily make a round hole, one perfectly square is not so easily obtained.

A friend sends us a sample casting and core, from which the attached full-size illustration has been prepared. The core is made from steel and has a slight taper and gives a perfect

casting. We are inclined to favor steel cores for this purpose over cast iron ones, as the latter metal is more granular and very liable to have its edges damaged.

We have no sympathy with the enterprising individual who attempts to use iron cores just as they come from the molder's hands, and then growls because he can not get them to leave the casting or that they do not leave a perfect hole. Let him make his iron or steel core perfect in the first place and his trouble will disappear.

A Founders' Trade School.

The introduction of chemistry, the greater use of machinery and the manufacture of specialties, which are features of modern foundry operation, demand a different class of men for managers or foremen today than was required 10 or 15 years ago. Instead of molders coming up to fit themselves to meet the requirements of the day, they are as a rule degenerating in all the qualities essential to the experienced and intelligent manager or foreman.

The general advancement of the art of founding to the high plane on which its intricate, difficult and scientific operations should place it, above all other trades, can only be attained through the education of the broadly-experienced molder. While it is a fact that we are to a great extent manufacturers of specialties, it would be better for the whole trade if those in control of specialty shops possessed a general knowledge of the different classes of work in the three branches of green sand, dry sand and loam molding. If managers of specialty shops possessed such knowledge they could not only use it to further economy and perfection in their specialties, but they would also be better fitted to recognize what was meritorious in all specialties and be able to judge what branch or class of work demands the greatest experience, skill and judgment, and is entitled to the highest wages. We have at this hour a serious labor dispute on this point in the city of Chicago, and the case is one that will not be settled on a basis of justice to the better mechanics. Without there is a broader education we may expect a continuation of the present faulty conception of the equipment demanded in the expert molder, and a great increase of the evils to come from inability to recognize what branches of the trade demand the best skill in the molder.

One may let a bench or light machinery work molder labor all his life in the same shop with molders doing intricate and difficult heavy work, and the former will never conceive the greater skill, judgment and caution called for in the heavy-work molder. This also applies to the proprietors or managers of specialty shops who are too often unable to conceive the difficulties of different classes of work. Let us give coming managers a broader education, and in time to come a different atmosphere would exist and a better appreciation of the highest achievements in founding.

Most all interested in foundry work are sufferers, whether they realize it or not, by the lack of facilities for a broad training in the essentials of the trade. This has been comprehended by many for some time back, and to assist in meeting the demands of the times, several colleges have been equipped to teach actual molding and cupola work in connection with technical knowledge that can be applied to the art. This is well in a way and good for the man that may be placed at the head of a large iron manufacturing concern, but for the man that is expected to assume the responsibility of direct management of the molder and cupola man, something different is required. The writer had hoped that the proposed Carnegie technical schools of Pittsburg might give this country the trade school which is now needed, but a recent visit made especially to interview the committee showed that these schools will closely follow the existing institutions, and hence will not serve the ends of the founders of today.

Our country is in great need of more practical training than our colleges now give. We have too many technical and not enough practical men. Our present system of college education misdirects the energies of too many men and often carries them along until middle life before they can get a start, if ever they do so. This nation should commence to direct the efforts of its youth more directly to practical ends and cut out that which will not serve their purpose. This for foundry work should mean that a man could so master the essentials in practical and technical training as to be worth from $2,000 to $10,000 a year by the time he is 24 years old. Some may think this impossible of achievement, but give the writer the kind of trade school he has in mind and he would prove the assertion to be true.

The kind of trade school required for teaching molding, mixing metals and cupola work, and educating the molder to be a competent manager or foreman of a modern foundry is one that should give experience in green sand,

dry sand and loam work, and in which light, medium and heavy castings best calculated to afford experience and aid in working out principles could be made. Four years, eight to nine hours per day, should be given up to actual work on the floor, at the cupola, etc., and the student should not be kept on one job any longer than required to demonstrate that he could not improve his practice in that direction. Such a course would mean an experience of six to twelve years in comparison with what one now gets in the general run of shops. Three to four evenings of every working week would be devoted to studies under competent teachers of metallurgy and chemistry of iron, drawing, construction of engines, etc., bookkeeping and a review of current literature on subjects pertaining to founding. This latter study would embrace illustrations of all difficult castings made outside of the trade school, that could be obtained.

The last three months of the student's course would be as an assistant to the general foundry manager, with the aim of teaching points in the intelligent management of men. This could be so formulated as to give experience that has taken many a whole life-time to obtain. At the present time, neither in colleges nor elsewhere is such instruction given. When one starts to assume management of men to-day he must pick out his own manner of doing so, and very often he ends his career following practices that are far from best for a manager or foreman. I have seen very able and intelligent men unaccustomed to managing workmen do very foolish things, and too often they have been the cause of strikes that could have been avoided had they been taught tact and skill in managing men. It is true that to a great extent the manager is born, nevertheless most men can be developed into more successful managers by instruction under an experienced and intelligent foundryman.

Is such a school as above outlined practical, and how can it be inaugurated? are questions that some may ask. To the first question the writer says yes, and in answer to the second offers the following plan of procedure, and as one appointed at the last convention of the American Foundrymen's Association at Buffalo, to learn what can be done, and to work for the establishment of a founders' trade school, he is in a position to entertain suggestions on the subject, and also, by the aid of those who may be appointed later, to push the project to a successful outcome:

The plan in brief for starting such an institution is to subscribe 100 shares in a non-assessable stock company at $500 per share, to be taken by any interested in founding, preferably by proprietors of shops that could give the trade school such work as it might select for the instruction of its students. No one person or firm should be allowed over two shares, so as to distribute interest in the school as broadly as possible. Of the proceeds of 100 shares, half to be invested in buildings and equipment, and half to be kept for working capital. The school to have a president, secretary, treasurer and foundry superintendent, all to be located in some prominent foundry center where teachers for technical training can be conveniently secured for evening sessions. To start the list of subscribers the writer will be glad to take two shares.

Foundrymen as a rule are not millionaires, nevertheless any that can risk $500 to $1,000 to advance this work can have the satisfaction of being pioneers in a movement that in years to come may receive much credit for the good it has accomplished. All should labor to leave the world a little better than they found it, and the writer believes this is one opportunity for doing so. While the proposition is to sell stock and endeavor to pay dividends as far as possible, it is not to be understood that gifts are not received. We have quite a few liberal minded men in this country who are looking for institutions that would merit a donation at their hands. This article may fall into the hands of such, and if any desire further information on the project advanced herein, the writer would be pleased to have them address him at Sharpsville, Pa. This address is also given for any that might feel disposed to invest in one or two shares to encourage the establishment of a founders' trade school. No money would be asked for until the matter was brought before the next convention of the American Foundrymen's Association. Officers could be elected by the stockholders at that time or at a later date, if so decided.—[Thos. D. West in *Iron Trade Review*.

The Hockensmith Wheel & Mine Car Co. of Irwin, Pa., intend incorporating at once under the above name, with F. C. Hockensmith, D. M. Wagoner and F. L. Shallenberger as members. Mr. Shallenberger is a new member, having until recently been with Phillips Mine Supply Co., of Pittsburg.

Fitting Up a Brass Foundry.

Several years ago it fell to me to plan for a new brass foundry in connection with a plant making brass fittings for steam and gas. The foundry was not a large one, employing six molders and the necessary core makers and laborers. The plan, Fig. 1, shows how the

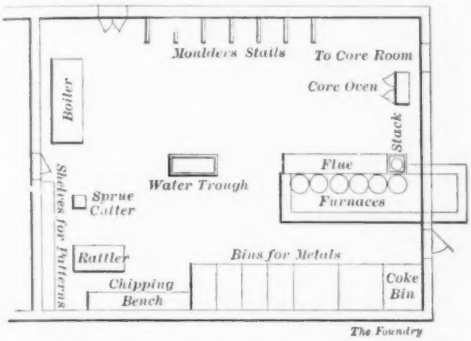


FIG. 1. PLAN OF BRASS FOUNDRY.

foundry was laid out and needs no explanation, except to say that it was about 45 feet wide and 60 feet long. The core makers had a room attached to the main building, and as there was considerable yard room for the storage of coke, only enough was brought in for each day and put in the coke bin, convenient to the furnace tender.

Over the furnaces was trolley and chain hoist to lift the crucibles and carry them to the clear space on the floor at the end of the furnaces, allowing ample space for the skimming and making ready to carry to the molds to pour off. The floor was paved, so that it could be swept each day and what brass was spilled in pouring could be saved. The paving was of good hard brick, but I think that vitrified brick would have been the cheapest in the end, as it is much harder and will stand harder usage.

Someone may wonder what a water trough is doing in such a prominent place. In a brass foundry a large trough of running water is a very necessary adjunct. In the first place, to get a nice color, such as is seen on valves and steam cocks, they must be dipped very quickly at a certain temperature determined by experience, and this cooling sets the color; although some use a cheaper metal and get the color by acid dips. The water also in the dipping causes the cores to blow out, leaving the insides of the casting clean, thus saving considerable expense.

The furnaces and their settings are shown

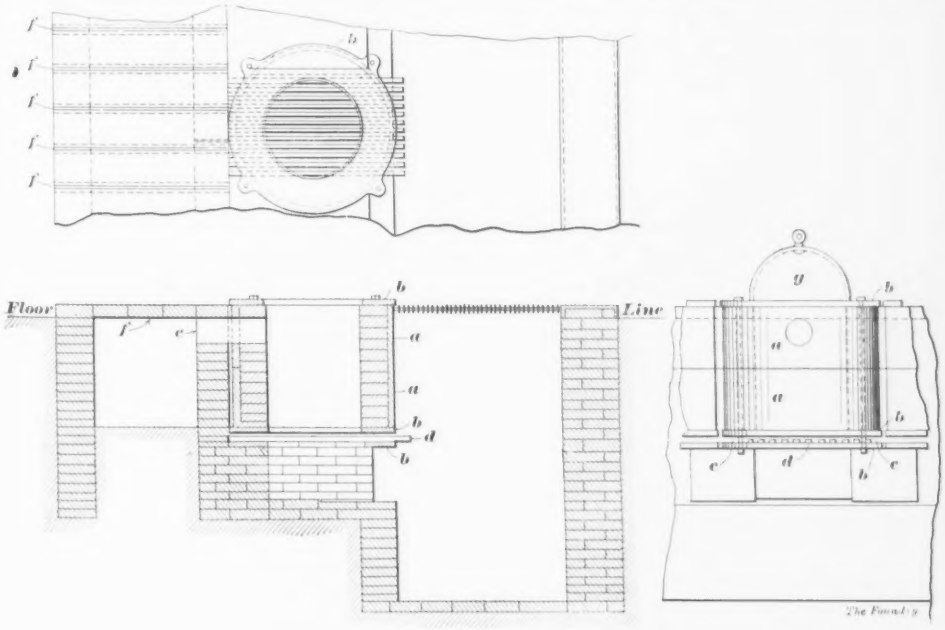


FIG. 2. BRASS FURNACES.

in Fig. 2. The body of each furnace was made of two pulley rims *a* about 34 inches inside diameter, 13 inches face and 1 inch thick. The top and the two bottom plates *b* are made of

cast iron, all from the same pattern. The two bottom plates are separated by two bars *c* 1½ inches thick, placed one on each side. The space thus made is for the grate bars *d*, which are of cast iron about 1 inch square by 40 inches long. The extra length protruding beyond the furnaces allows them to be caught hold of to be shaken, or to pull them out to dump the fire when the day's work is done. This is usually done by a pair of long tongs being worked through the grating.

The furnaces were lined with regular rectangular fire-brick (as they were easier to get in the open market and cheaper than the segmental shapes), taking care to well fill all the crevices with fire clay, and the space between the brick and the casing with pieces of old fire-brick and clay. The small connecting flue *e* between the large flue and the furnace was made of pieces of 6-inch wrought-iron pipe. A damper may be put in this pipe if so desired, but we did not find it necessary. The large flue was built of common brick and at the end of three years it was still in good condition. This flue was put up with the idea in view of having six more furnaces on the opposite side, when business demanded it. The brick top was held in place by cast-iron tee rails. This flue led to a stack 20 inches diameter by 40 feet high, which had an excellent draft.

The furnaces were set upon brick piers as shown, and the pit was made deep enough for a man to walk in front of the furnaces to shovel the ashes out. The pit, as shown in the plan, went outside of the building; this was so that the grating would not have to be taken up and also to keep the dirt made by handling the ashes out of the foundry. If there is room, the part outside should slope up into the yard so that a wheelbarrow can be used in the pit. The ashes should be gone over very carefully to save any brass lost when filling the crucibles.

There should be a sewer connection in the pit, and the bottom should slope toward it, as water will sometimes get in, and should a crucible break while in the furnace and the hot metal strike the water, there will be trouble. I remember such an accident several years ago, the result of which was that the furnace tender took an enforced vacation of about 30 days for repairs to himself. The space in front of the furnaces over the pit is covered with an iron grating, and the wall around the pit should be protected with a coping of stone or iron. The cover *g* on the furnace is what is used by many, but something more flat would be better, as then the crucible of hot metal would not have to be hoisted so high to pass over the other covers on its way to the pouring floor.

In the old foundry the molders worked over a trough, Fig. 3, which held the sand and the flasks while the molds were being made, and such an arrangement, so far as I have ever seen, is common in brass foundries. The troughs were about 8 feet long and they were

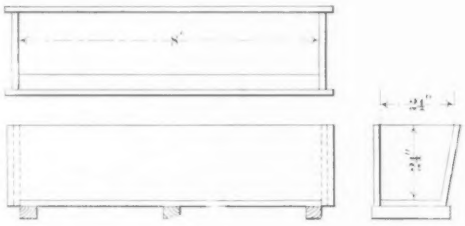


FIG. 3. MOLDING TROUGH.

arranged around the sides of the shop next to the walls, taking up considerable space; in fact, so much that only a few men had the benefit of the windows, and then the troughs held only about enough sand for one heat, and as each man put up three heats per day, his sand was quite warm after the first heat, and hot sand is not the best thing for good castings. In the summer a foundry is not, at its best, a very cool place, and to have to stand over hot sand and work was rather trying, to say the least, to the men.

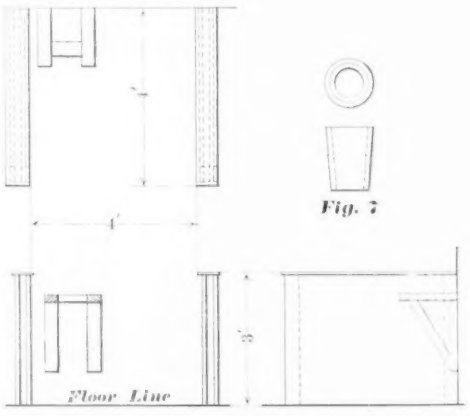


FIG. 4. A MOLDING STALL.

It was decided to give the stall system, such as is used in snap flask foundries, a trial. One stall was put in, like Fig. 4, and given a fair trial, with the result that the molders found it easier to do their work, as the sand was in a more convenient position, and they also es-

caped that peculiar side movement they had to make in shoveling from the trough. They also had the benefit of plenty of sand always handy and in two piles, so as to use them for alternate heats, and thus escape the hot sand trouble. Each molder had a window, so as to get plenty of air and light. The bracket fastened to the wall held the flask while the mold was being put up, and was of a convenient height for the molder and was made of 2x4-inch hemlock. The sides forming the stall were of 1-inch hemlock plank.

The ledge to the left provided a place for the molder to lay the gate of patterns, matches, etc., when taken from the mold. His tools, parting sand, facings, etc., were on a shelf in front of him, and his riddle was hung on a peg within easy reach. The sand he was using was in a pile at his right, at the upper end of the stall, and another pile to be used for the next heat was at the right-hand side of the entrance to the stall. While the heat was being poured one of the laborers shoveled this pile to the back end where the former sand had been. The flasks and follow-boards for each molder were placed on a line with the left-hand partition, so that no two molders came in contact with each other.

The core oven was a very simple yet very

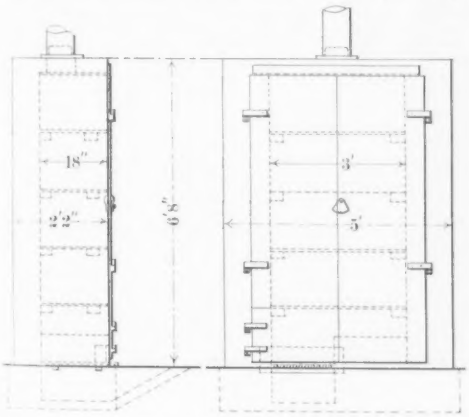


FIG. 5. CORE OVEN.

effective one, as can be seen by Fig. 5, and it can be built at very little cost. It will bake the cores very rapidly, as the heat is direct. The walls were of common brick and the top also, only the top bricks were held in position by cast-iron tee bars, as shown. The fire-box needs no description, unless it is to say that the grate bars were of cast iron taken off the same pattern as the furnace bars were. The shelves to hold the cores may be made of 3-16 or ¼-inch boiler plate, punched full of ¾-inch holes to let the heat pass through the lots of cores on the different shelves. Cast-iron shelves might be better, as they would not warp; but I do not think the difference in results would pay for the pattern, as we found after several years' trial that the plate shelves had not warped enough to cause any annoyance, and for fuel we used gas-house coke, which makes a very hot fire.

The flue from the core oven was made of 7-inch stovepipe, such as one gets from the stove stores, and was run over to the stack leading from the furnaces. The doors were of sheet iron, with two of them on the fire side, so as to be able to get at the fire without opening the whole oven.

FIG. 6. POURING TROUGH.

Fig. 6 shows a cast-iron trough for catching the drippings of brass, when the molds are poured on the end, as in this position more or less runs off; and Fig. 7, although a very simple looking affair, was the cause of much happiness for the furnace tender, and sorrow for the watchman—in fact, it might be called in this case the "watchman's eye-opener"—although it was merely an iron crucible without a bottom. In brass foundries there is much copper wire and clippings of sheet copper used, and this iron crucible was for forming these into convenient shapes for handling. The wire or clippings were pounded into it by using an iron ball about 4 inches diameter cast on the end of a rod, and, when no more could be pounded in, the pot was turned over and the mass was knocked out.

The dimensions given in this article are only general and can be changed to suit some other fellow's ideas, or surrounding conditions. I trust that this may be a help to someone who is groping for light on the subject, as I had to do a few years ago.—[J. G. C. S., in *American Machinist*.

The Brighton Foundry Co., Chicago, has been incorporated with a capital stock of $6,000. The incorporators are Philip Summers, Olaf Westberg and Ernst Magull.

William S. Cleaves has become manager of the Portage Lake Foundry & Machine Co., Hancock, Mich.

Deaths.

Lloyd Booth, who died recently at Youngstown, Ohio, was born near Albany, N. Y., in 1834. He entered the employ of Emery Bros., operating a machine shop at Albany, when a young man. He had a bent toward mechanics and soon became an expert machinist, holding positions at Buffalo, N. Y., and Scranton, Pa. Later he went South as a locomotive engineer and lived at Knoxville, Tenn. On the breaking out of the war he returned to the North and worked first at Susquehanna, Pa. At Meadville, Pa., the firm of Dick, Fiske & Co., machinists, was organized, with Mr. Booth as a member. About 1870 he went to Youngstown and the firm of Booth & Margerum was formed, which later became Booth & Miller, a machine shop and foundry business being carried on. Mr. Booth in time assumed control of the business. The Lloyd Booth Co., incorporated several years ago, had one of the largest foundries in the Central West, and the establishment had long made a specialty of chilled rolls and rolling mill machinery. A short time ago, it was merged in the United Engineering & Foundry Co., of which Lloyd Booth was a director and his son, Chas. H. Booth, an officer.

LLOYD BOOTH.

John Jacob Wagoner, of the firm of Fieser, Wagoner & Bentley, Columbus, O., died at his residence, 4549 Greenwood Ave., Chicago, Sunday, Sept. 1, from heart disease. Mr. Wagoner was born in Cincinnati, 1848, where he was educated, and resided there until five years ago, when he removed to Chicago to take charge of the branch office in that city of the firm of which he was a member. His first employment was with Dickson, Clark & Co., wholesale hardware dealers, of Cincinnati, with whom he remained for a number of years. He severed his connection with this firm to enter the pig iron business by becoming a salesman for Rogers, Brown & Co., with headquarters at Cincinnati. He later became a partner in the firm of Miller, Wagoner & Bentley, of Columbus, O., and represented it in the Chicago territory.

JOHN J. WAGONER.

Personal.

C. Lane has taken charge of the foundry department of the Cassopolis (Mich.) Mfg. Co.

M. F. Dunn, superintendent of the malleable department of the Sattley Mfg. Co., at Decatur, Ill., has resigned to accept a similar position with another concern.

Herbert E. Ramp, who for many years has been at the head of the foundry of the Crescent Iron Works, at Springfield, Mo., has accepted the position of foundry superintendent with the C. S. Bell Co., of Hillsboro, Ohio.

Frank Johanes, foreman of the U. S. Cast Iron Pipe & Foundry Co., at Columbus, O., has been promoted to the position of superintendent of that plant.

J. J. Johnson, foreman of the Alabama Steel & Wire Co.'s foundry at Ensley, Ala., has resigned and will return to his former home in Chicago.

The foundry department of the Youngstown (Ohio) Engineering Co. will be in charge of Edward Trotter.

Fires.

The machine shop operated by James Christian at Crowley, La., was damaged to the extent of $3,000 by fire.

A recent fire did $10,000 worth of damage to the plant of the Industrial Foundry Co. at Cincinnati, O.

The foundry and machine shop of the Milwaukee Valve Co. of Milwaukee, Wis., were totally destroyed by fire, with a loss of $20,000.

The plant of the Lehigh Foundry Co. at Fullerton, Pa., was destroyed by fire. The loss is estimated at $50,000. The foundry will be immediately rebuilt.

Moore & Butts' foundry and machine shop at West Newton, Pa., burned Sept. 4.

R. S. Putnam's foundry and machine shop at Mendon, Mich., burned Sept. 10. Loss $5,000.

It is estimated that $8,000 damage was done to the Copp foundry at Hamilton, Ont., by fire Sept. 7.

Among the Foundries.

The Cornell Machine Co., of West Superior and Pratt streets, Chicago, has sold its business and good will to the Ellington Manufacturing Co. The latter company is building a large plant at Quincy, Ill., but until the plant is completed will conduct its business at Chicago.

The Peru Steel Casting Co., Peru, Ind., recently celebrated the anniversary of their first heat. The first year of the company has been extremely successful. They have built up a large business which has constantly kept the works running to full capacity. This is due, it is stated, to the excellent quality of the steel produced, which is not only extremely tough, but is also soft, so that it machines well, and further is remarkably uniform in its characteristics. The company use the basic open-hearth process exclusively and claim to be the first to be able successfully to use basic steel for the manufacture of all classes of castings for machine and railroad work. The company are enlarging their main buildings for the purpose of securing more room for their finishing department.

The Bridgeport Malleable Iron Co., Bridgeport, Conn., are about to replace some of their old buildings with new ones in connection with their gray iron department in order to afford improved facilities for their work.

Stephens, Adamson & Co., engineers and machinists, Aurora, Ill., have recently installed a line of pulley molding machines and have added to their original shop equipment several machines for turning and finishing iron pulleys and sheaves.

The Alamo Mfg. Co. have purchased the machinery, stock, patterns and factory complete of Olds & Hough, at Albion, Mich., and are consolidating the same with the plant at Hillsdale, Mich. Two new buildings are being erected. Mr. Olds becomes superintendent of the Alamo Mfg. Co.

The Altoona Foundry & Machine Co., recently organized at Altoona, Pa., have commenced work on their new buildings in that city. They will cover an area of 100 x 170 feet.

S. J. Wright, proprietor of the Peninsula Foundry Co., has purchased a tract of land at Newport News, Va., where ground has been broken for a new foundry, 200 x 75 feet. The old foundry at Newport News will continue work. A specialty is made of bronze, brass and iron castings.

The Angola Engine & Foundry Co. is building a plant at Angola, Ind., for the manufacture of gas engines as well as conducting a general jobbing business. The plant consists of a foundry and machine shop. The foundry is a brick structure one story high, 40 x 70 feet, and is now about completed. The machine shop will occupy a brick building 48 x 70 feet, three stories high including basement, on which construction is rapidly proceeding.

The company expect to begin manufacturing operations about Nov. 1. The gas engine which they will build is of special design in which important improvements have been embodied. The equipment of machinery has been largely ordered. F. D. Morse is president, J. W. McCrory is secretary and manager, O. Carver is treasurer, and B. Wood is superintendent.

The Gadsden (Ala.) Foundry & Machine Co. has been incorporated with a capital of $10,000, for the purpose of manufacturing tram cars and other mining appliances. The incorporators are W. G. Bellenger, C. P. Smith, J. W. Williams, H. B. Murphy, F. W. Bellenger and R. B. Kyle.

The Seiberling & Miller Co. of Doylestown, Ohio, have been organized and expect to have a plant in operation by January 1. The new company has $100,000 capital stock, and will manufacture mowers and reapers and other agricultural machinery. The erection of the plant was begun Sept. 1. The main building will be three stories high and will be 50 x 150 feet. The first floor of this building will be used as the drill shop, gearing and erecting department. On the second floor will be located the pattern shop and the testing department, and on the third floor will be located the paint shop. The foundry will be 60 x 110 feet, and will contain the molding department, core room, grinding and cleaning departments. The engine house will be 50 x 50 feet. The warehouse will be 36 x 120 feet, and will be two stories high.

The Goetz & Brada Mfg. Co., who have long been located at 18 to 28 Michigan street, Chicago, expect to remove their manufacturing operations to Chicago avenue and Sangamon street in the same city in about two months. They have purchased a site 113 x 300 feet, on which they are erecting a factory which will be four times the capacity of their present plant. The new works will comprise 1 large building to be used as a brass and copper works and machinery department, another building to be used for a tank shop, and a third building to be used for a blacksmith shop, besides smaller structures for stabling and other purposes. The main building will be 60 x 113 feet, four stories high, the tank shop will be 90 x 150 feet, one story 40 feet high, and the blacksmith shop will be 40 x 40 feet, one story high. The works will be equipped with the most improved modern machinery.

T. C. Alcott & Son of Mount Holly, N. J., have acquired by purchase the entire plant and patents of John W. Taylor Mfg. Co., formerly known as T. H. Risdon & Co. The combined plants of this company will hereafter be operated by the incorporators, Thomas J. Alcott and his two sons, Edgar A. and Howard E. Alcott, under the name of the Risdon-Alcott Turbine Co. Their product will be turbines and appurtenances almost exclusively, comprising the large assortment of patterns of the Risdon turbine, in both cylinder and outside register gate styles, the high duty turbine, of inside register gate pattern, and the Taylor sleeve gate turbine, cylinder gate type.

The Werner-Schenck Co., brass founders, Milwaukee, Wis., has been succeeded by the Standard Brass Mfg. Co.

At the last annual meeting of the Hartford Foundry Co., Hartford, Conn., it was decided to increase the capital stock to $100,000. The company's foundry will be increased to 300 x 75 feet, and is to be equipped with the latest compressed air and electrical machinery. The officers are: Theodore M. Lincoln, president; J. W. Conway, vice-president and superintendent; Ernest H. Cady, secretary and treasurer; J. G. Bulkley, assistant treasurer.

The Montana Iron Works, of Butte, Montana, was incorporated last week with a capital of $24,000. T. P. Newton, J. J. Egan, A. E. Hook and C. J. Ashton are the incorporators.

The Semi-Steel Co, of Chagrin Falls, O., was recently incorporated with a capital of $25,000. The officers are F. B. Squire, president; G. W. Balkwill, vice-president and manager; W. C. Bruce, treasurer; Howard E. Cole, secretary. The company has purchased the plant of the Ferro-Steel Co. of Chagrin Falls, O. It will make a specialty of brake shoes, street car equipment and light castings. Quite a number of large orders are already booked. Of the officers, Mr. Squire is vice-president of the Standard Oil Co., Mr. Balkwill is mechanical engineer of the Bowler Foundry Co., and Mr. Bruce is president and general manager of the Bowler Foundry Co., of Cleveland, O. Mr. Cole is connected with the Standard Oil Co. Paul Tafel, also a director of the company, is chief chemist of the Frasch Process Soda Co.

The Cahill Iron Works, Chattanooga, Tenn., has completed a new warehouse and finishing department and will replace its old foundry with a larger and more modern structure.

The Washington Foundry Co. of Spokane, Wash., has been incorporated with a capital of $5,000. The new company will manufacture stoves and ranges and cooking utensils. The incorporators are Samuel and Arthur J. Katzenstein and Thomas and Ellsworth Caufield. A foundry will be erected immediately.

The American Brass Co., with headquarters at Waterbury, Conn., has secured control of the Holmes, Booth & Haydens Co., of Boston, Mass. The combination has a capital stock of $10,000,000, of which $8,000,000 is outstanding. The constituent companies comprising the combination are as follows: Coe Brass Co., Torrington, Conn.; Ansonia Brass & Copper Co., Ansonia, Conn.; Benedict & Burnham Mfg. Co., Waterbury, Conn.; Waterbury Brass Co., Waterbury, Conn.; Chicago Brass Co., Kenosha, Wis.

The Elizabeth Brass Foundry Co. of Elizabeth, N. J., has been incorporated with a capital of $50,000. C. C. Bussey, C. M. Whitney and J. T. Hague are the incorporators.

The Sargent Co., of Chicago, is finding such a demand for its steel castings that it is contemplating additions to its plant at Chicago Heights.

For the better conduct of its business, the English Supply & Engine Co., Kansas City, Mo., has separated its foundry and machine shop from its regular business and organized two distinct concerns, viz.: "The English Iron Works Co.," devoted to the manufacture of steam engines and boilers, and "The English Supply Co.," which will handle the same lines as heretofore and distribute the product of the English Iron Works Co. Both concerns will be conducted by C. C. and T. F. English.

The Vilter Mfg. Co. of Milwaukee, Wis., will erect a foundry 110 x 280 feet at a cost of $25,000.

The Tarrant Foundry Co. of Chicago has leased the plant at Aurora, Ill., formerly occupied by the Hercules Ice Machine Co., and intends to manufacture its castings at that point.

A two-story factory, 303 x 103 feet, will be erected at Philadelphia, for the Quaker City Metallic Bedstead Co.

Chas. Johnson has established a foundry at Newark Valley, N. Y.

The Pennsylvania Steel Co. has placed its new steel foundry at Steelton, Pa., in operation. It is the intention of the company to increase the capacity of both its iron and steel foundry.

Charles Ward, T. L. Johnson and others have bought Christopher Bros.' foundry and machine shops, at Gadsden, Ala., and will organize a $10,000 stock company to operate same in the manufacture of tram and mining cars.

The brass foundry at Worcester, Mass., operated by Oakley & Taylor, has changed hands, the former selling his interest to Mr. Taylor, who will continue the business.

The Crown Smelting Works of Chester, Pa., have closed down their iron foundry department and will hereafter devote their entire plant to the manufacture of brass and bronze work.

The Globe Iron Bedstead Mfg. Co. has been organized at Birmingham, Ala., with a capital of $10,000.

The Atlas Engine Works, Indianapolis, Ind., will build a new foundry at a cost of $25,000.

The South Bend (Ind.) Chilled Plow Co. will build an addition to its plant, 200x48 feet.

The Macbeth Iron Co. of Cleveland was recently incorporated, to succeed Macbeth & Co. The new company will continue in the structural iron and general foundry business. Its capital is $80,000. The directors are Thomas Macbeth, A. D. Macbeth, C. W. Kelly, L. S. Dickey, C. J. Snow. Thomas Macbeth is president; C. W. Kelly, vice-president; C. J. Snow, secretary and treasurer, and L. S. Dickey, formerly superintendent of the Globe works of the American Shipbuilding Co., is general manager.

The Southern Pacific will enlarge and improve its shops at Houston, Tex. The new buildings will include a foundry, 100 x 140, a coach and woodworking shop, 120 x 240, an addition, 70 x 140, to the machine shop, and an addition, 50 x 50, to the pattern shop.

The J. A. & P. E. Dutcher Co., Milwaukee, Wis., is making extensive improvements and additions to its foundry, which will double the capacity.

The Deering Harvester Co. of Chicago will erect a one-story brick foundry at a cost of about $8,000.

The Pennsylvania Stove Co. has purchased the plant of the Ellwood Bath Tub Works, Elwood City, Pa. The buildings will be remodeled and will be fitted up for the manufacture of stoves and ranges.

The Globe Iron Works at Wichita, Kan., has changed hands and is now under the management of E. L. Fonda, L. Prell and J. N. Carter. Its former owner, Mr. A. Flagg, has retired from business.

The capital stock of the Sattley Mfg. Co., with plants at Springfield and Decatur, Ill., has been increased from half a million to a million dollars.

The Phoenix Foundry at Ripley, Ohio, which has been in existence for nearly fifty years, and is the property of the Parker estate, is to be thoroughly overhauled. Walter A. Knight, of Cincinnati, O., as manager, will install modern equipment in both foundry and machine shop.

L. Engleman, who for several years has been foreman at the St. Joseph (Mich.) Iron Works, has resigned and will erect a new foundry, which will be known under the name of L. Engleman & Son.

The Foster Bros. Mfg. Co. of Utica, N. Y., has broken ground for a new foundry, which will be 60 x 125 feet in size.

The Lebanon (Pa.) Foundry Co. has leased the old Mish Foundry in that city and will operate same with a force of fifty hands.

The Chattanooga (Tenn.) Stove Co. is having estimates prepared with a view of increasing the size of its plant.

The Excelsior Stove & Mfg. Co., of Quincy, Ill., is building an addition to its plant.

The Collins Plow Co. of Quincy, Ill., is reported to be considering the advisability of erecting a foundry for the production of the castings it consumes, which amount to about five hundred tons of gray iron yearly and four hundred tons of malleable. J. W. Brown is manager of the company.

It is stated that the Lees Machine Works of Cannellton, Ind., will be removed to Owensboro, Ky.

A report from Americus, Ga., says Messrs Skinner & Sawyer will establish a foundry in that city.

The W. J. Smith & Sons Mfg. Co., of Kansas City, Mo., manufacturers of haying tools, road scrapers, etc., will extend their trade to the implement field and in connection with other additions to their plant will also erect a foundry.

The Ellis Keystone Agricultural Works, Pottstown, Pa., will commence the erection of a foundry 60 x 100 feet, so constructed that the company can add to the length of it should necessity so require. It is the intention of the company to do a general foundry business, both in iron and brass.

Weldon & Clark have leased the Drinkhouse Foundry at Phillipsburg, N. J., and will, after making extensive improvements in the building and machinery, operate it with a full force of men.

The Stratton & Gilborne Mfg. Co. of Aberdeen, S. D. has applied for a charter. The company, it is announced, will at once begin the erection of a substantial machine shop and foundry, which will be equipped with all the machinery required for the making of artesian well outfits and for doing a general business in the machine shop and foundry lines.

The Kerrihard Co. of Red Oak, Ia., will build a new foundry, 32 x 72 feet.

An addition 300 x 100 feet is being made to the plant of the Pierce, Butler & Pierce Mfg. Co. at Syracuse, N. Y.

At a meeting held in Pittsburg recently the company operating the Homer Brass Works of Philadelphia, Pa., was reorganized with the aid of Pittsburg capital. The firm name has been changed to the Homer Brass Works, Incorporated, of Pittsburg and Philadelphia, with C. S. Frishmuth of Philadelphia, president; James L. Hukill of the Pennsylvania Car Wheel Co., Pittsburg, vice-president; A. R. Bassett of the Pennsylvania Car Wheel Co., treasurer, and L. R. Wooldridge, secretary. The company is engaged in the manufacture of plumbers' supplies, though the manufacture of a general line of brass goods will be taken up later. The location of a branch plant in Pittsburg is being considered, but has not been decided upon. The brass finishing department of the plant at Philadelphia will be enlarged and new machinery installed.

H. S. Weirick has purchased a controlling interest in the Cureton Foundry Co. of Mt. Vernon, Ohio. The concern will continue to be known by its former name.

The U. S. Cast Iron Pipe & Foundry Co. has started its West Superior, Wis., plant after a long shut down. The product is largely for western trade.

The Peerless Mfg. Co. of Louisville, Ky., is erecting a new foundry.

Advice to President Schwab.

Our enterprising fellow-countryman, Mr. Charles M. Schwab, has had his salary raised. He has gone to work for the United States Steel Corporation in the capacity of president, and will receive about $15,386.54 every Saturday night, provided, of course, that his employers pay their help weekly. Mr. Schwab is but thirty-nine years old, and *Commerce, Accounts & Finance*, with its customary interest

in ambitious young men, takes this opportunity to offer him a few words of advice.

In the first place, Mr. Schwab should realize that he now has a good steady job at fair wages, and must do his best to keep it. He should avoid being late at the works in the morning, and should never run the risk of being docked. To be docked a day's pay would mean a loss of over $2,500, and that would go a good way toward paying the grocery bill. He should not take more than an hour's nooning and should be respectful to the directors when they speak to him. If he feels that his salary is low for the amount of work done, he should remember that it is customary to begin rather low and work up, and when he knows more about the business he can ask for a "raise." Besides, salary isn't the only thing.

Be economical, Mr. Schwab. So many young men nowadays live beyond their means. Don't pay too much house rent. The rule which says that a man's rent should never exceed one-fourth of his salary is a good one. You should be able to hire a nice, comfortable house for $200,000 a year and the water rate. Perhaps you can do even better than this in your town, where rents are, in all probability, low. The building and loan associations are helps to young men who wish to own their own houses. Don't build too expensive a house, however.

Live well, but not luxuriously. Have plenty of plain, wholesome food, and not many expensive puddings and desserts. A soup or stew followed by a baked Indian pudding or a cornmeal mush makes a good dinner. Don't have too much company, and use lamps instead of gas for lighting purposes. Pay your bills every week, and don't buy goods on the installment plan. It would not look well, in case the directors of the steel company were calling at your house to have the furniture people come and carry off the plush parlor set for non-payment.

Your new position will naturally call for increased social obligations, and you should meet them cheerfully. Mrs. Schwab should keep a servant. For a few hundred dollars a week one of the Pittsburg girls would, doubtless be willing to come in and do the housework. Buy a good black suit for best, and see that Mrs. Schwab has at least one calling dress and a Sunday gown and bonnet.

But, above all, save money. Mr. Russell Sage recently said that a young man should save a quarter of each dollar he earned. If you did this you would have, at the end of the year, $200,000 put by for a rainy day. In a few years you would thus be able to stand quite a spell of wet weather.

So, Mr. Schwab, *Commerce, Accounts & Finance* bids you go on and prosper. We have great hopes of you, and believe that, with economy, you will have no trouble in keeping out of the poorhouse. Do not let anything we may have said lead you to believe we consider your salary is a meager one. You are getting good wages. In fact, we know editors, great leaders of thought, who get no more for their services than you do for yours.—[*Commerce, Accounts & Finance.*

Some Chemical Changes in Malleable Iron After Annealing.

Some experiments have been carried on at the foundry of the Sterlingworth Railway Supply Co., Easton, Pa., to determine the changes which take place in a white iron casting after the same has been annealed. J. Howard of Duquesne, Pa., says in the *Iron Age* that the sample bar was taken about the time half the heat was run out of the furnace and was 10 inches long, 2 inches wide and 1¼ inches in thickness. The piece from which a sample was broken for "white iron" analysis was annealed in the same pot with a lot of brake heads and fulcrums, whose maximum thickness was not an inch. When the castings were sufficiently annealed the sample was broken in two, and one part marked "first anneal" for analysis, and the other put in with a fresh lot of castings and annealed for a second time.

An analysis of the "white iron" resulted:

Analysis of White Iron.

	Per cent.		Per cent.
Silicon	0.84	Total carbon	2.30
Sulphur	0.051	Graphitic carbon	0.16
Phosphorus	0.202	Manganese	0.44

In order not only to determine the change in the annealed from the white iron, but also to ascertain that taking place in the annealed piece, inside and surface, a sample was taken from the surface, about ⅛ inch in thickness, by a planer, and another sample from the core, along its greatest dimension by a drill. Analysis yielded the following results:

	Outside layer.	Core.
Silicon	0.84	0.84
Sulphur	0.090	0.053
Phosphorus	0.18	0.018
Manganese	0.45	0.44
Total carbon	1.39	.....
Graphitic carbon	0.64	.....

These four elements do not differ much from their original per cent in the white iron. The outside layer of the piece annealed the second time was the same thickness as that of the first anneal and showed the following composition:

Outside Layer, Second Anneal.

Silicon	0.75
Sulphur	0.090
Phosphorus	0.22
Manganese	0.55
Graphitic carbon...0.193; by HNO_3, 1.13 sp. gr.	
Graphitic carbon.....0.203; by HCl, 1.12 sp gr.	
Total carbon	0.29

A comparison of these with the previous results shows a great change, especially in the carbon, which was given off as carbonic acid or a complex carbide. That termed "graphite" is not so strictly speaking, but "temper carbon," and is quite difficult to burn off. The sulphur is another important factor, having increased from 0.051 in the white iron to 0.090 during the two annealings. The pieces were packed in mill scale and lathe turnings and the sulphur was probably absorbed from that source, although no analyses were made of the packing.

The Tropenas Process at the Works of the Sargent Co.

In our February issue we gave a short illustrated description of the works of the Sargent Co., at Chicago Heights, Ill., which makes a specialty of turning out steel castings by the Tropenas process. Mr. E. L. Adams of the Sargent Co. has an article in *The Technograph*, a publication of the University of Illinois which is of special interest to those who contemplate manufacturing steel castings and from which we reproduce the following:

A great development has taken place, within the past few years, in the application of steel castings to machine construction in lieu of forgings or castings of other metals. This has been due to a number of valuable characteristics of steel castings, which make their use suitable to a large variety of work. Chief among these features is the ability to obtain a metal of high tensile strength and ductility, in shapes difficult or impracticable to forge, and at a price in most cases lower than that of a forging. Machine parts formerly made in cast or wrought iron can be considerably reduced in weight by the substitution of steel. This fact has been appreciated by the railroad companies in particular, as applied to locomotives and car designs. As an instance of this, a reduction in weight of nearly four tons was made on a passenger locomotive by the substitution of steel castings for forgings and iron castings. Steel castings can also be made of high magnetic permeability, and have therefore been largely adopted by manufacturers of electrical machinery.

Steel for castings is now made by the three following processes or modifications of them: 1. The open-hearth process. 2. The crucible process. 3. The Bessemer process.

The open-hearth process is particularly suited for the manufacture of large castings, owing to the comparative cheapness and uniformity of the melted metal. In making small castings of thin section, it is essential that the metal be very hot and fluid as it is poured into the mold, since molten steel cools with great rapidity and will otherwise not completely fill up the mold. It is commercially impracticable to make small castings from open-hearth steel on account of the large amount of metal which would be lost by skulls in the ladles and by bad castings. Moreover, as ordinarily operated, the capacity of the furnace ranges from eight tons upward and this must all be tapped at one time. These facts necessitate having the pouring floor set with molds to the capacity of the heat and thus in the manufacture of small castings a very large pouring floor is required.

Small castings are made very satisfactorily from crucible steel. The objections raised to this process are its high cost of operation and the large equipment required in proportion to the tonnage of material manufactured.

The Bessemer process recommends itself for a number of reasons as an acceptable method of producing steel for small castings. Presuming that a sufficiently hot and quiet steel of the proper quality can be obtained, one of the greatest advantages it offers is the elasticity in the quantity of its product. With a converter of, say, two tons capacity the output may be governed by the fluctuations in orders, or by the capacity of the molding and pouring floors. The open-hearth furnace, to be worked economically, must be run day and night in order to avoid the loss in gas and labor entailed in keeping the furnace hot while idle. But with the converter process, the principal sources of expense are stopped when the pouring is finished.

In order to obtain sufficiently hot steel by the Bessemer process, a number of modifications have been made in the original process, by variations in the method or place of introducing the blast. The best known of these methods are the Robert, the Walrand-Legenisel, and the Tropenas processes, named after their

inventors. In the Robert process, the blast is introduced on the side of the converter, while in the Tropenas, the blast is directed upon the surface of the bath. The Walrand-Legenisel process makes use of much smaller charges than the other two, and the blast is delivered in the ordinary way, at the bottom of the vessel. As to the success with which these various processes have fulfilled the practical requirements demanded of them—for uniform quality and cheapness of output—it may be stated that the first two processes named have not met with the general approval which the claims put forth for them would warrant. The Tropenas process, though only recently introduced into the United States, is now being operated here in a number of foundries.

The largest installation of the Tropenas process in this country is at the works of the Sargent Co. at Chicago Heights, Ill. In this plant three converters, of a capacity of two tons per blow each, give a total daily output of 50 tons. The steel foundry building covers a floor space 50 feet wide by 200 feet long, served by two electric traveling cranes. The three converters are placed in a row in an opening in the side wall at the south end of the main building. Behind these converters, in a separate addition erected for the purpose, are two cupolas which furnish the melted pig iron and scrap from which the steel is made. The cupolas are set on high foundations, and deliver the melted metal to the converters by gravity through hinged spouts which can be turned out of the way during the time of the blow.

The converter is lined with ganister, and consists of a shell of 5/8-in. steel plate fitted with two hollow trunnions supported on pedestals. By means of the trunnions the converter may be tilted as desired for charging, for blowing, or for pouring the steel into the ladles. One of the trunnions is connected with the wind pipe from the blower, and conducts the blast to the wind boxes at the rear of the converter. On the converter trunnion opposite to that delivering the blast, a large sprocket wheel is fitted, over which passes a chain fastened to two pistons working in a pair of cylinders placed side by side in a pit below the floor line. This apparatus, operated by hydraulic power and controlled by valves at the blowing platform, furnishes the means of tilting the converter. The hydraulic pump, accumulator, etc., are situated in an adjoining room.

The air blast is obtained from a Root's rotary positive-pressure blower directly connected to a 65-h. p. motor. This blast is delivered to the converters through a 12-in. main at a maximum pressure of 4½ lbs. per sq. in. The pressure of the blast is regulated at the blowing platform by means of a gate valve on an 8-in. bypass from the main air pipe. The quantity of compressed air required is from 770 to 880 cu. ft. per minute per ton of pig iron treated.

The arrangement of the tuyeres is the chief peculiarity of the Tropenas over the so-called "Baby" Bessemer process. The wind boxes previously mentioned are independent of each other. The lower wind box connects with a row of horizontal round tuyeres known as "fining" tuyeres or "tuyeres of reaction," placed in the lining above the position of the surface of the bath. The upper wind box opens into a row of flattened tuyeres of a smaller section than that of the lower ones and about 6 in. above them. These tuyeres are known as "tuyeres of combustion." The blast for the upper tuyeres can be operated independently of the lower tuyeres. All the tuyeres are placed in the horizontal plane in order to prevent the blast from causing any gyratory action on the bath.

In the Walrand-Legenisel process, the air is blown through the bath at a considerably greater pressure than that used in the Tropenas process, and the metal is placed in a violent state of ebullition. The aim of the Tropenas process is to keep the bath as quiet as possible, the claim of the inventor being that "the most impure steel manufactured by the pneumatic process is that produced from a bath which has received the largest amount of churning in its molten state." For the same reason also the shape of the lining is such that the surface of the bath exposed to the blast is small in comparison with the quantity of metal in the bath.

The operation of the converter is as follows: The pig iron and scrap are first melted in the cupola. The chemical analysis of the pig iron employed is within the following limits:

Silicon	from 2.50 to 3.50 per cent
Manganese	from 0.50 to 1.25 per cent
Carbon	from 3.00 to 4.50 per cent

The phosphorus and sulphur contents should be as low as possible, the sulphur not exceeding 0.06 per cent and the phosphorus 0.07 per cent. The proportion of scrap which can be charged with the pig iron varies with the analysis of the pig iron. Before the converters can receive the melted iron, its lining must be brought up to a high heat. This is done by means of an oil flame. When the proper amount of iron has been tapped into the con-

verter, the blast is turned on in the lower tuyeres and the converter is turned up so as to bring the lower tuyeres just above the surface of the blast.

The complete operation of the blow is divided into three periods, the whole blow taking from 16 to 22 minutes, depending upon the quality of the metal charged. The first period is the time during which the silicon is being oxidized, and lasts until the carbon begins to become oxidized. In a normal blow, this period lasts from four to eight minutes, during which time about 4½ lbs. air pressure is carried and the upper tuyeres are not used. The second period commences when the carbon flame is well up above the mouth of the converter. The pressure is then reduced to 3 lbs. and kept at that point until the carbon flame is perfectly white, when the upper tuyere valve is opened and the pressure is again slightly reduced. The second period is the boiling point and lasts from four to eight minutes. At the end of this period, the flame drops rather suddenly. In the third period, the blast is gradually increased and the flame again increases and fluctuates and finally begins to turn red, first at the top of the flame and then at the edges. At this point the blow is finished, the converter is lowered, and the blast is turned off. There now remains in the converter a bath of nearly pure iron. The proper proportions of the carbon, manganese, and silicon contents of the steel required are brought up by additions of ferro-manganese or ferro-silicon, or both of these, to the bath in the converter and the metal is poured into the ladles as required. By changing the proportion of the final additions or "dose," steel may be obtained varying in quality from the softest to the hardest grades.

By the use of the upper tuyeres, the carbon monoxide liberated from the bath is changed to carbonic acid gas, which adds to the temperature of the steel without increasing its cost. The steel thus obtained is very hot and fluid. The high temperature attained during conversion is mainly produced by the burning out of the carbon, manganese and silicon. The iron charged into the converter has a temperature of about 2,300 degrees F., which is raised to about 3,100 degrees F., during the period of the blow. The silicon furnishes the fuel for most of this rise in temperature, it being estimated that each 1 per cent of silicon thus burned is equivalent to a rise in the temperature of the bath of 500 degrees F. As previously stated, the bath at the end of the blow before the dose is added, is nearly pure iron. Samples of this metal have shown an analysis only 0.20 to 0.25 of 1 per cent of impurities. From this metal castings may be produced of great magnetic permeability approximating that of Swedish iron. In respect to the physical qualities of the steel produced by the Tropenas process high results have been obtained from tests. Tests made upon annealed specimens have shown 65,000 lbs. tensile strength per sq. in., with an elongation in 2 in. of 35 per cent and a reduction in area of 40 per cent.

Among the factors tending to militate against the commercial success of the Tropenas process are its complexity and the waste of metal during the operation. This loss in cupola and converter runs from 17 per cent up.

Some Printed Things.

The 60-page illustrated catalogue recently published by the Smooth-On Mfg. Co. of Jersey City, N. J., is a very interesting and instructive book. It tells about the different Smooth-On compounds, what Smooth-On is, gives illustrations of its application, and tells why it is valuable to the Engineer, Machinist, Iron and Steel Founder, Steam Fitter and Plumber. Copies will be sent upon application.

The Empire Engine & Motor Co., of Orangeburg, N. Y., have issued Catalogue No. 2, describing their "Empire Air Tools," comprising drills, reamers, hoists, crane motors, and other appliances. Copies may be obtained by addressing the manufacturers.

"Methods of Chemical Analysis and Foundry Chemistry" is a book of considerable interest to foundrymen issued by Frank L. Crobaugh, proprietor of the Foundryman's Laboratory, Cleveland, Ohio. Part one deals with analytical methods and suggestions for obtaining a correct analysis. Part two treats of the application of chemistry to foundry practice. Copies will be mailed to any part of the United States for $1.50. To foreign countries the price is $2.00.

The Buffalo Forge Co. of Buffalo, N. Y., have issued a little brochure illustrating their volume blowers and exhausters. Copies sent free upon request.

"How to Become a Good Mechanic" appears in its second edition. Its publishers are the Industrial Publication Co. of New York. The price is twenty-five cents, and most any one seeking to make himself a better mechanic

should be able to find that much information within its pages.

The "Story of Shan Dai," Pharaoh's chief boilermaker, has been published in pamphlet form by Joseph T. Ryerson & Son of Chicago, of whom copies may be obtained.

A piece of work, well befitting the largest stove foundry in the world, is a recent catalogue issued by the Michigan Stove Co., Detroit, Mich. Enclosed with it is a fine likeness of Jeremiah Dwyer, president of the company, and founder of the stove business in Detroit, with which he has been identified over fifty years.

J. Gilmour, Bennett Building, New York, representing several manufacturers in that important district, has issued a catalogue of the foundry equipment handled by him. Copies will be mailed on application.

The B. F. Sturtevant Co. of Boston are mailing their engine catalogue No. 103 to the trade.

The Farwell automatic molding machine is illustrated in a neat pamphlet recently gotten up by the Adams Company of Dubuque, Iowa. Those interested in the rapid production of light castings may obtain a copy by addressing the manufacturers.

"A Handbook for Apprenticed Machinists" is a little volume for the young men of the machine shop, gotten up by the Brown & Sharpe Mfg. Co. of Providence, R. I. It was originally only intended as a self help for the apprentices of that shop, but the popular call for something of this character induced the Brown & Sharpe Mfg. Co. to get out a second edition, and to add considerable more information to its pages than was found in the original volume. Copies may be obtained from supply dealers or direct from the Brown & Sharpe Mfg. Co. The price is fifty cents.

The Chicago Pneumatic Tool Co. of Chicago are mailing to the trade a finely illustrated special circular showing the numerous uses to which their tools are adapted.

The Buffalo Forge Co., of Buffalo, N. Y., has issued a special catalogue of the great variety of steam engines it builds. Copies will be mailed upon application.

A fire in the foundry of the Gerst Bros. Manufacturing Co., St. Louis, Mo., gained considerable headway before it was discovered. Fortunately, the pattern room was saved from destruction. The loss on the building is estimated at $3500 and on the stock of the company at $5000. The damage is said to be fully covered by insurance.

Two Ways of Making the Same Casting.

While loose pieces on a pattern are very often used to advantage, there are numerous instances in which cores effect a considerable saving in labor and also secure a more satisfactory casting.

The illustration, Fig. 1, is a case in point. This pattern was supplied as shown, with the

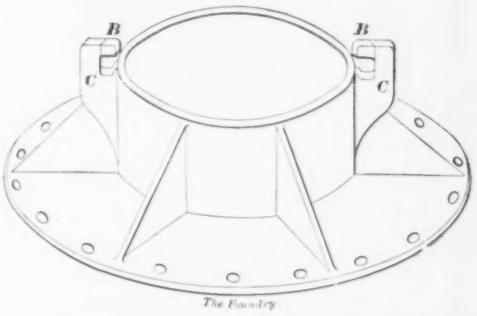


FIG. 1. PATTERN WITH A PROBLEM IN MOLDING.

two small lugs marked B dovetailed on, and the parts C sliding on to the bracket underneath. A casting from this pattern weighs 200 pounds, and the time taken to mold it was seven or

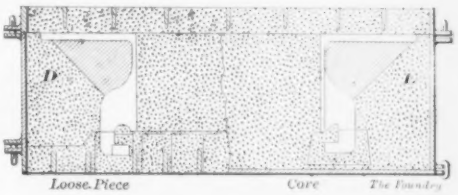


FIG. 2. SECTIONS OF MOLD SHOWING TWO WAYS OF MOLDING THE SAME PIECE.

eight hours. After making two or three castings, I came to the conclusion that a lot of unnecessary work was being done. Fig. 2 shows two sectional views of a mold; D section is as molded with the loose piece, and E section with it cored out. As will be seen, a three-part flask was used in the first instance, while with the aid of the core a two-part flask was used, and three castings were produced in ten hours, with no more exertion on the part of the molder than when making the one in the first instance.

Fig. 3 shows core box and core print with portion of pattern attached. In molding, the flask is rammed up level with the prints, and the prints, with pattern attached, are rapped and drawn out. The core is then dropped in the place of the print, the plate is clamped to

the drag, and the flask rolled over. The core box (iron) was made in a couple of hours

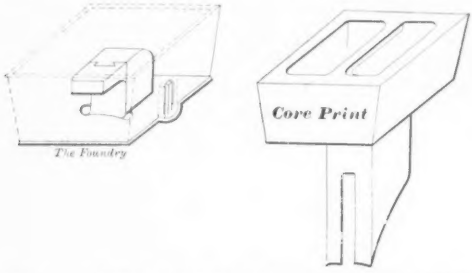


FIG. 3. CORE BOX AND CORE PRINT WITH PORTION OF PATTERN.

with the lugs fixed to the pattern.—[George Buchanan in American Machinist.

Casting Copper.

The Process Copper & Brass Co., of Jersey City, N. J., in a recently issued circular says:

"Metallurgists claim that when copper is liquid it absorbs the gases readily, and as these are given out on solidification, it is very difficult to get castings free from blow-holes. The practice is to add from ¼ to 1 lb. of spelter and from 5 to 10 oz. of phosphorus to every 16 lbs. of copper to cast the mixture solid, and foundrymen in general, call this mixture copper. Thurston's 'Materials of Construction' gives a test of this so-called copper as follows: Tensile strength, 27,800 lbs. per square inch. Elastic limit, 51.80 per cent. Elongation, 6.47 per cent.

"A metal that possesses only 6.47 per cent elongation is exceedingly brittle, while copper, on the other hand, is very tough and ductile, and can be drawn into wire. Cast copper, therefore, as known to the trade, is simply alloyed copper. The conductivity of alloyed copper castings is less than 33 per cent of that of pure rolled copper. The heat conductivity is proportionately lessened. The metal no longer forges at a cherry heat. It fuses at a lower temperature. It does not hold heat satisfactorily. It is more generally and readily affected by acids. It is not uniformly solid and homogeneous, and frequently the alloy is found to be in spots. It is claimed by us simply that the crystals of copper in a molten state are repellant, and in casting, the metal when cooling becomes porous and spongy. Our process purifies, strengthens, toughens and casts copper solid and free from blow-holes. The treatment acts upon all crystals of the metal alike, to the extent that they come together face to face in harmonious union. Copper treated by this process is given life and elasticity. It forges without injury or fracture at a cherry heat, and under friction it remains noticeably cool. A chemical analysis will show the purity of the copper; but a better way is to subject the metal to an electrical test. Copper castings made by us have, time and again, been subject to chemical analysis and electrical test, and are known to be absolutely free from alloy.

"A test made before the Franklin Institute in Philadelphia, Pa., wherein a bar of pure copper made from rolled copper, a bar of the best obtainable alloyed copper, and a bar of pure copper cast by our process were placed in competition, demonstrated the fact that our bar had a conductivity equal to 93 per cent of that of the rolled bar, while the alloyed bar showed only 24 per cent conductivity. Making allowance for the lesser density of a casting, as compared with rolled metal, the electrical conductivity of a pure copper casting should be the same as that of pure rolled copper. This expresses the conductivity feature of copper treated and cast by our process to a nicety. A machine test of copper cast by our process made by N. O. Olsen, shows the following: Tensile strength, 28,470 lbs. to sq. inch. Elastic limit, 12,500 lbs. to sq. inch. Elongation, 37 per cent."

They Do a Little Experimenting in the Far West.

Workmen in Fitzgerald's foundry had a miraculous escape from death from an explosion peculiarly caused. A little molten metal remained in the large cupola after casting was finished at 8 o'clock and the door in the bottom was opened, letting the metal down.

Some water had gathered beneath, and when the melted iron reached it a tremendous explosion occurred that blew out windows and sashes, boards in the side of the building, the sky-light, scattered patterns and tools to the imminent danger of life and limb and brought the big brick cupola to the floor. Wonderful to say, no one was injured. The loss approximates $200 and work will be suspended for some time.—[Dayton (Wash.), Correspondence.

The Youngstown Iron, Sheet & Tube Co. will increase its capital stock from $1,000,000 to $2,000,000 and erect a large open-hearth steel plant adjacent to the works. The company are now building a plant in the eastern part of Youngstown, O. It will include a well equipped foundry.